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EDITORIAL NOTES.

A Nine Months' Wages Stabilization.

THERE will be considerable satisfaction in most quarters of the gas industry that the National Joint Industrial Council for the Gas Industry have arrived at an agreement which stabilizes wages for a further period of nine months—to June 30 next year. This decision is due to the good sense which prevails on both sides in the discussions of the Council, and which surveys matters not from any narrow basis, but from the broad one of the conditions as they exist, and those which there are fair grounds for believing will arise, together with the probable effects of the whole upon the industry and its capacity for employment. The times are such that the industry must put forth all its strength and energy for protecting and advancing its interests; and its workers are naturally potent factors in rendering assistance to this end. Whatever they can do to promote the welfare of the industry contributes to the stabilization of their employment; and this their leaders fully recognize.

The decision regarding stabilization was arrived at last Wednesday; but the fair provision that was made for stabilization somewhat below present rates or a continuation of the latter, dependent upon the cost of living figure, has operated in favour of the stabilization of existing rates. The agreement provided: "That, if the cost of living "figure as appearing in the 'Ministry of Labour Gazette' "for the month of September is 60 or below this figure, "then wages shall be reduced as from Oct. 1, by 4d. per "shift in the case of shiftworkers, and ½d. per hour in the "case of day and other workers, and that a corresponding "decrease shall take place in the case of pieceworkers, and "the wages so reduced and the conditions of gas-workers "shall be stabilized as from Oct. 1, 1927, for a period of "nine months—that is to say, to June 30, 1928. If the "cost of living figure as appearing in the 'Ministry of "Labour Gazette' for the month of September, 1927, is "above 60, then the existing wages and conditions of gas-"workers shall be stabilized until June 30, 1928." It has since been officially ascertained from the Ministry of Labour that the cost of living figure which will appear in the "Labour Gazette" for September is 65, so that the existing wages and conditions of gas-workers will therefore be stabilized until June 30 next.

It should be mentioned that the stabilization will not prevent: "(*a*) Any readjustments that might be agreed "arising from the inquiry into gas-fitters' rates and con-"ditions; (*b*) Regional Councils from dealing with the re-"grading of any particular undertaking; and (*c*) the right "at present existing of Trades Unions to approach Re-"gional Councils or individual gas undertakings for the "purpose of endeavouring to obtain further holiday con-"cessions." Although there is ground for regret that the cost of living has not further receded, the freedom from interference with the general wages of the gas industry for the next nine months is something over which the Joint Industrial Council and the industry generally may be congratulated. If the cost of living falls, the gas workers will be the gainers.

Speeding-Up Carbonization and Gasification Processes.

THOSE of our readers who have carefully read the communications and discussions at the British Association meetings, as reported in our last two issues, will have been struck by several matters, and through them will have been impressed by the fact that our knowledge at the present time is very limited regarding the potentialities of coal and of carbonization and gasification processes. Instructive contributions in this respect were by Dr. C. H. Lander, Director of Fuel Research, and Prof. J. W. Cobb. To them Dr. A. Parker contributed in the discussion; while Prof. R. V. Wheeler in a further paper showed that, though our knowledge of the chemistry of coal is developing, we are far from the position of being able to assert that it is complete. Dr. Lander gave statistics as to the distribution of the use of coal in this country; and he submitted that our fuel utilization is very imperfect. With that we all agree, as also with his suggestion that means are already available whereby great improvements could be made—where there is the will. His contribution and that of Prof. Cobb, however, enforce the truth that, though our knowledge of these matters has expanded, there is a vast field for further research before we can come to any determination as to the lines that will have to be followed to realize in the national interests the best results from coal. But, were investigations of problems which have so far received treatment more advanced than is actually the case, we should still be unable to apply the knowledge satisfactorily without detailed information regarding individual coals, and there again we have great complexity. However, we are looking to the Fuel Research Board, through the survey which is being diligently made of Nature's stores in the coal areas, to enlighten us, if not with exact knowledge, with information that is sufficiently so to enable us to pursue a more orderly course in our coal purchasing and utilization than is at present possible. Prof. Cobb, in his contribution, insisted upon the necessity for more rapid carbonization and gasification processes, if raw coal for many purposes is to be replaced. He instanced possibilities in that direction which are highly suggestive, and contain promise which encourages good hope. Beyond that, at present, we cannot go; but the promise is such that we can exercise the needed patience for the Department of Coal Gas and Fuel at the Leeds University to develop their work in this respect for the Institution of Gas Engineers, which means for the gas industry.

We will presently indicate the lines along which research has been carried as mirrored by Prof. Cobb, and which is at present all experimental, and merely precursory or fundamental before any attempt can be made to carry forward investigation to the working stage to ascertain whether or not there is corroboration. Leaving that for the moment, and reverting to Dr. Lander's paper, it has been pointed out that he referred to the distribution of the utilization of coal in this country. We would make the point (as was effectively done by Prof. Cobb in his

communication) that the gas industry at the present time utilizes coal with great thermal efficiency, which in some cases reaches 80 to 85 p.ct. where waste-heat boilers are employed, and, of course, taking into account the calorific value of the secondary products—coke and tar. This shows that gas undertakings where the best standards of process and supervision exist are using coal with great economy; and the aggregate of the progress made in such economy is reflected by the Board of Trade Returns. From these it is seen that, while in 1920, 17,566,316 tons of coal were utilized by the statutory gas undertakings, in 1926 the quantity was 16,564,172 tons. In the latter year the total amount of gas made was 296,082 million c.ft., while in 1920 it was 256,977·74 million c.ft. These figures show that in 1926 the coal carbonized was 1,002,144 tons less than in 1920, while the production of gas increased by 39,104·26 million c.ft. Of course, water-gas manufacture, steaming, &c., are involved in these figures; but the only point in connection with them which we here wish to make is that the gas industry has achieved a considerable saving in the utilization of raw coal by higher efficiencies and new methods of working, without in any way affecting its efficiency of service to the community. The communication by Dr. Lander, however, was largely directed not to what the gas industry is doing in this respect, but to another need of the nation, and that is the provision from coal or oil, with a view to minimizing as much as possible our reliance upon the importations of this necessity to our well-being and safety. On the assumption that, if the remaining coal in Great Britain can be taken as representing 180,000 million tons (which, by the way, Prof. Arnold Lupton considers is only about half the quantity still available in this country), and is capable of yielding an average of 10 gallons of oil per ton, then we have actually in store in this country 1,800,000 million gallons of oil, which is a supply far exceeding the estimated petroleum reserves of the United States. Notwithstanding this large potential supply of oil, we are, of course, limited in its economic production by the extent of the use we can make of fuel in this country. It is, therefore, easy enough to calculate that, as oil must be regarded as a secondary and not a primary product, to enable it to take a commercial place with imported petroleum, it would not be possible wholly to satisfy our needs for oil by pretreatment of coal; and therefore, whatever is done, it may be regarded as a certainty that, for a long period ahead, we shall have to depend to a fairly considerable extent upon imported oil and spirits.

Let us now revert to Prof. Cobb's contribution, which concentrates attention on the problem of speeding-up our carbonization and gasification processes. We of the gas industry are proud of our thermal efficiency in the utilization of coal where the best practices obtain; but thermal efficiency must not be the end of our ambitions in respect of production. In carbonization and gasification work, capital expenditure stands for much; the character of our products is also of weighty importance. If it be possible to change our methods in such a way that we can profitably speed-up the work of the producing plant with, on balance, financial gain, this will be a valuable advantage to add to that of thermal efficiency; and if, in the process of accelerating the work inside the retorts, we can also improve the coke, without corresponding disadvantage in any other direction, then the gain will be better still. These are, to the gas technician, the fascinating problems upon which Prof. Cobb and his staff are working in the interests of the gas industry. It is their fundamental experimental work which is promising; but there are so many problems involved in it that plodding, careful work is necessary; and therefore those who are watching for the results must be patient. In considering the nature of the work, it is essential that the observer or student should get well embedded in his mind this sentence from Prof. Cobb's contribution: "The outstanding technical factor "limiting the economies of carbonization seems to be "that of speed." In other words, we have reached, practically speaking, our limits in thermal efficiency; and the speeding-up of carbonization and gasification processes appears to be the direction in which to turn for further improvement.

Various avenues suggest themselves for exploration in which means might be found to bring about the speeding-up; for it has to be admitted that the present carbonization process is very slow. There are the questions of retort material, the rate of heat penetration, the constitution of the coal, the nature of the ash constituents, the character of the charge in respect of thickness and density, and other factors—such as the rate of escape of the volatile matter, and the degree of expansion and contraction of the charge. The last-named matters involve such questions as the chemical composition and size of the coal particles, and whether they should be carbonized separately or in admixture. Then there are the possibilities of blending coals, and studying the effects of carbonizing them at different temperatures and rates of working. It is a big complicated investigation; and we do not envy the investigators their "job," however interesting and fruitful. Among the points made by Prof. Cobb is that more radical methods of speeding-up carbonization could be employed if coke could be accepted in powdered form, as it might be, for example in the raising of steam. From the reading of his communication, however, not much hope is given of being able to secure a material for the retort structure of better heat penetrability than those known and used at present, except at prohibitive cost. Therefore, quicker heat penetration to the charge, and causing radiation and convection to become more rapidly operative, are clearly bound up very intimately with the characteristics of the charge itself. The quest that is being made is to ascertain whether or not anything practicable can be done to alter these. The line along which Prof. Cobb is proceeding, and therefore the one which he obviously believes to be the most promising, is to modify, if possible, the chemical behaviour and reactivity of the coal constituting the charge. He asks, How far is it practicable to catalyze the reactions with which we are concerned in the carbonization and gasification of coal? And in this connection he referred to the well-known work of Lessing and Haber. The research at Leeds shows that lime, oxide of iron, and soda influence materially the process of carbonization. Scanning the results, it is found that, by the addition of 5 p.ct. of these materials, on the laboratory scale, much finer grained, stronger, and more homogeneous cokes have been obtained. Though a full explanation is not yet available, the hypothesis is that the evolution of volatile matter during the plastic stage is slowed down, and the swelling or honeycombing of the coke lessened on that account. On the larger scale, the special cokes were not obviously different in structure from pure coke made without additions—this presumably because the process was so much slowed down that the differences were smoothed out. But Prof. Cobb thinks it likely that, in a process of rapid carbonization on any scale, the differences would be retained. In the larger scale results, the gas yield was increased 20 p.ct. with a sodium carbonate coke; and the ammonia yield 35 p.ct. with a calcium carbonate coke. The cokes made with lime, oxide of iron, and particularly sodium carbonate gasified much more quickly, and gave a much better water gas. We cannot quote here all the interesting figures which are given on p. 550 of the "JOURNAL" for the 7th inst.; but from them it is evident that the reactivity of coke to steam is so far enhanced by the additions that the rate of working can be increased tenfold or more without impairing the quality of the gas. The results were obtained when working at a temperature of 1000° C.; and at lower temperatures the influence of the added constituent is in some ways even more remarkable. For fuller information on these and other matters, reference must be made to the paper.

Of course, Prof. Cobb does not submit the findings as anything more than, at the present stage, purely experimental. They are far from representing the working-out of a technical process, or even the completion of laboratory research. However, the more the work is considered, the deeper grows the interest in its suggestiveness and promise. We feel convinced that to effect progress in carbonization—in speed and productive results—there must be concentration upon the charge; and in gasification, any enhancing of the reactivity of the coke to steam will have an important part. Hence the quest at Leeds.

Competition and Civic Government.

THERE was a time when some writers in the electrical papers freely, persistently, and emphatically expressed the opinion that the days of gas were numbered. The idea was both amusing and amazing; and, examine the position how one would—whether from the thermal, economic, or constancy points of view, or the need of the country for the secondary products of coal carbonization for the maintenance of industries—one could never ascertain the grounds on which, with such dogmatic fervour, the statement was made. The authors took good care, and thus evidenced excellent discretion, not to make disclosure, which could only have accentuated their foolishness. But the times have changed. As the facts of the position have become embedded in their minds, and as the Board of Trade returns have shown, with undeviating regularity, that the business boundaries of the gas industry are extending year by year, there has been a recession from the old declarations. Not a few men in the electrical industry have always realized that in the interests of the country the gas industry must live; and probably they, like us, have never been able to detect any reason why the country's economic and public service progress should receive a set-back by the sweeping of the gas industry from the face of the earth. That industry has never wished to see the electricity industry slaughtered in order to advantage itself. All it has submitted is that each agent has special province with well-defined limits in which it can show superiority, and to those limits claim should be confined. However, the number of electrical men who see things in a new light is increasing; and now there are, very properly, signs of a desire to get together and to work together, in respect of matters which are of common interest.

This was instanced at the meeting, last week at Brighton, of the Institution of Public Lighting Engineers, the members of which, irrespective of profession or interest, were entertained at luncheon by the Chairman (Mr. A. M. Paddon, M.Inst.C.E.) and the Directors of the Brighton and Hove Gas Company. On the occasion, as will be seen by our report, Mr. Paddon had some very wise things to say on the subject of the old antagonism of the two industries, the changing attitude, and competition generally. Competition is usually spoken of as something that is beneficial. No one would deny that it is so—up to a point; but unrestricted competition, in such commodities as gas and electricity, may have an effect which would not be to public advantage. Mr. Paddon emphasized this in referring to the time when "it was held, with no particular intelligence, that one could not have too much competition." But with the progress of events, it was borne in upon those responsible for public undertakings that, whatever benefits competition might bring, it had also very serious disabilities and dangers. By the multiplication of overhead charges, it is found to be a menace to economy; and, under its stress, bad work is apt to take the place of good. That competition may be carried to such lengths that it becomes a detriment to the consumer was demonstrated in the early days of gas lighting, when London streets contained the competing systems of several gas companies, which resulted in prices to the consumers in excess of what would otherwise have obtained, in the struggle of the companies to make both ends meet. The electrical industry has found within its own borders that excessive competition has been of little benefit to them in respect of equipment in consumers' houses.

Mr. Paddon is a lawyer as well as an engineer, and he practises at the Parliamentary Bar. He has had occasion to examine certain of the projects for the centralization of the generation of electricity supply, with the result that, in his view, those in authority, in avoiding the Scylla of competition, have nearly come to grief on its antithesis the Charybdis of centralization. It is clear that he shares the grave doubts of many experts as to whether this countermove of concentration and centralization is not going too far, and bringing in its trail certain disabilities of its own. "Because just as competition wars "against efficiency and economy—the very efficiency and "economy that it affects to promote— so when one comes "to this centralization of industry at its source, there is "a tendency to sterilize individual and particular excel- "lence and aspiration, and to reduce the general average "of results to something like mediocrity. This is the "danger." The major part of our friends of the electricity industry realize this; they are disturbed over the question as to whether any economies which may accrue at the point of generation will not be dissipated to the full and more in transmission.

This links-up to a point upon which, in a measure, there will be some disagreement with Mr. Paddon. He asked, with the two dangers to which he had referred menacing those in public authority, who is to decide? His answer was, "Our civic authorities." The explanation of his selection was: "By the nature of their office "and of their duty, they are peculiarly well placed to "hold the balance evenly between the claims of processes "or methods by which the public are to be served; and "where they control these processes and methods, they "may be trusted, as a matter of duty and interest, to "apply them impartially, justly, and equitably to the "public use." The submission may be accepted where, in the case of trading rivals such as gas and electricity, the authorities are not prejudiced by possession of one of the supplies, or are not swayed in their decisions by party policy. Both these are dangers in civic government; and both, unfortunately, have grown considerably in late years, as those in intimate, local contact with the facts are fully and even painfully aware. What do we find? Although gas undertakings are among the largest of ratepayers, in many cases where our civic authorities are the administrators of electricity and not of gas supply, fair commercial competition is deliberately ruled-out, and, in every direction in which the authority has control, the business by some means is handed over to the electricity concern without regard to over-all merit. In such cases, it is only when we get to the business which is outside the decision of the civic authority that we find the real arbiters—the public. Where local authorities do not govern one or other service, or do manage both services, then a different state of things exists, and usually impartiality; although occasionally it is found that, even then, the strings that are pulled, political bias, and even the novelty of making a change, have brought about eviction of the one service and the installation of the other without regard to respective merits. Where absolute impartiality reigns, and the conditions are favourable to the running of the two services, they make progress side by side in a satisfactory manner. We wish the facts permitted our giving unqualified support to the view of Mr. Paddon. It expresses the position as it ought to be; but, unfortunately, it does not universally prevail.

Fuel Technology as a New Profession.

THE scientific work that is proceeding in connection with fuel utilization is bound to have a large beneficial effect in all industries. It is broadening outlook among industrialists; and those who lag behind in the adoption of its teachings will be made to toe the line by those who are wideawake, and who quickly appreciate and apply the lessons. This effect can be positively predicted. The efficiency of the employment of fuel plays an important part in works economy; and no manufacturer can for long allow his competitors to get in advance of him in respect of any factor in production costs. That the vigorous competition of the times will not brook. In this country something like 180 million tons of coal are used annually for industrial and domestic purposes, of which quantity only about 20 p.ct. (or 36 million tons) is consumed in the stoves or grates in our homes. Nearly 2000 million gallons of oil are also imported for use. These are impressive figures; and they compel attention to the need for every effort being made to realize the full thermal and chemical values of the fuels, for the simple reason that the difference between good and bad utilization represents a vast amount of money.

There is abundant evidence that at the present time indifferent utilization predominates, and good utilization therefore takes second place. This position must be reversed; otherwise the country cannot succeed in its

domestic and international competition. Appreciation of this has obtained larger practical hold in other countries than in this. Fuel in its various forms represents a large field; its efficient utilization in the ramifications of application, a great necessity. Attention is drawn to these matters by an article which Prof. J. W. Cobb contributed, in response to an invitation, to the "Manchester Guardian" Commercial Supplement for Sept. 8. It forms one of a series on "Little-Known Callings;" and the object of the contribution is to impress the importance of fuel technology as a new profession. The value of fuel and the means for its utilization are so immense that it is a surprise so much time has passed without wide recognition that here there is scope for trained men to ensure from day to day the realization and maintenance of the highest efficiencies, consistent with over-all economy. Illustrating the wastage arising from the imperfect application of existing knowledge and well-understood processes, Prof. Cobb refers to the steam-boiler. It is a reflection upon our industrial ways to have to confess that, on the average, not more than from 50 to 60 p.ct. of the heat in the coal used for this purpose is obtained in the steam on a boiler plant; and yet, in modern, well-equipped —and it should be added, supervised—power houses, an efficiency of approximately 80 p.ct. is secured. If a plant is fairly modern, and properly installed and controlled, then there is scope for a 20 p.ct. fuel economy, which ought to be largely brought into account. Attention is next drawn to the wealth of products derived from the carbonization of coal in gas-works and at coking plants —all put in such a simple manner that "the man in the street" cannot fail to be interested in the advantages of such treatment of coal. Even here there is a double avenue for the fuel technologist. In the first place, there is the growing conviction that the advantages so secured ought to be obtained as far as possible from a much greater bulk of our coal supplies; in the second place, the carbonization process is one that offers ample opportunities for improvement and development—it being realized that high yields of valuable products may be procured by modifying the process in the proper direction. The knowledge of this has produced great activity in small and large scale experiments on carbonization and gasification in all directions. In short, a great struggle is going on in the development of processes to secure, as Prof. Cobb puts it, "a fuller utilization of the potentialities of coal." A point which is often overlooked is that the highest success of these processes is not solely dependent upon their own attainable efficiency, but supplementing this is the efficiency of their working, and of the application of their products. This we well know in the gas industry in relation to the production and utilization of our primary product and the chief secondary one.

Of course, in an article such as the one by Prof. Cobb, it is impossible to mention the countless applications of fuel; but it is patent that there is scope everywhere not only for improvement in the utilization of coal, but for the realization from it of, in addition to its heat, the numerous valuables it contains. For this purpose, for the development of fuel processes, and for their efficient working and maintenance, competent men are required; and men of different types in respect of training and ability. There is a vast amount of work to be done, requiring, in the laboratory, men combining in their qualifications those of the chemist, physicist, and engineer. The scientific processes have to be carried to the stage of industrial operation; and here the combination of scientific practice and practical science are needed in those who design and direct. Following comes the need for conducting manufacture by the developed process, and knowledge and ability must extend to industrial and commercial organization. There are several parts, and advancing parts, to be taken by the trained fuel technologist. As Prof. Cobb says, "it is becoming more essential every day that the executive officers of industrial organizations should be men who have received scientific training which will enable them to understand thoroughly the results of laboratory work and small-scale experiments, and have a faculty for translating their knowledge into successful commercial practice." The day is passing when those into whose care the administration of large enterprises is placed considered it was sufficient to effect a sort of compromise, "based upon a supposition that a so-called practical man with no scientific knowledge can carry out the management of an essentially scientific operation, and be placed in the position of supreme executive officer if he is only provided with a research chemist to supply scientific advice." Opinion is now gaining stronger foothold that men who direct works' management must know the science underlying the processes, and be in the position to discuss them with the understanding necessary for the formation of right decisions.

Consideration of the facts of the present situation in relation to fuel and its utilization brings us to the definite conclusion that the many developments in fuel technology are opening out a new profession; and that the demand for men with the necessary scientific knowledge is not only a long way ahead of the supply, but likely to become even more so. In the training of men for such work, Leeds took the lead in 1907, when the gas industry endowed the Livesey Professorship. London, Sheffield, Manchester, and other universities have since made provision for the study of fuel. Naturally Prof. Cobb uses as an illustration the course of training at Leeds; and there is no question as to its completeness, pursued industriously and successfully from the opening to the end. The "calling" of fuel technologist may be little known; but this is a defect that Prof. Cobb's contribution should help to rectify. The scope for work and the demand for men exist; it is to the interest of the country (as well as to that of many young men) that the demand should be satisfied.

Chief Engineer and General Manager for Manchester.

A great deal of interest has been aroused by the decision of the Manchester Corporation to appoint a General Manager and Chief Engineer, to which matter reference was made in last week's issue. An advertisement is published in our columns to-day, inviting applications for the post, at a commencing salary of £1500 a year.

Zonal Gas Prices.

A notice in our "Miscellaneous News" shows that the Sheffield Gas Company are making a further reduction in prices, from the September quarter, of ¼d. per therm. The Company charge lower prices in ascending bolts of consumption. Up to 500 therms, it will be 6½d. per therm. Consumption between 500 and 2500 therms will be charged at 5½d. In the next zone—2500 to 15,000 therms—5d. is charged; and between 15,000 and 30,000 therms, 4⅝d.; all consumption in excess of 30,000 therms, 3d.

Institution of Public Lighting Engineers.

The annual meeting of the Institution at Brighton was highly successful, from the points of view of both technical matter and social engagements. The only thing that operated to mar the visit was the heavy rain—particularly on Tuesday. Reference is made to one speech in our editorial columns to-day; there are a few points in the technical proceedings upon which there will be comment in a later issue.

Legacy for the Benevolent Fund.

We have many memories not only of the good words but of the acts of the late Mr. Daniel Irving. At the last meeting of the Council of the Institution of Gas Engineers, at which the President (Mr. H. D. Madden, M.Inst.C.E.) presided, it was reported that the Benevolent Fund was to benefit by a legacy of £100 from Mr. Irving, who was a Past-President of the Institution. Over a long period, Mr. Irving took the deepest interest in the Benevolent Fund. We would suggest that, when bequests such as this are made, the name of the friend leaving the money should be perpetuated in the published Fund accounts.

Coal Output.

During the week ended Aug. 27, the output of coal was 4,682,000 tons; the number of wage earners being 984,500.

Coal Imports.

During August, the imports of coal amounted to 2945 tons, which is a little more than normal according to the return for the same month of 1925. But what a difference between that figure and those for the corresponding month of last year! It was no unusual thing during the coal stoppage for the imports to reach 4 million tons in a month.

French Coal Ban.

Information received from Paris shows that the restrictions on the import of coal into France have not yielded any great benefit to the French coal industry. The month of July, it is true, saw a decrease in the imports of coal of about 200,000 tons; and there was a similar diminution in the quantity of coke sent into the country. The significance of the latter fact is that there are no restrictions on the import of coke; and therefore it is obvious that the decrease was due to a general slackening in industry, and a smaller requirement for fuel. Furthermore, the output of French coal declined by about 100,000 tons between April and July, and fewer workers have been employed in the industry. Notwithstanding, stocks have continued to increase; and therefore considerable energy is being shown in trying to develop the export trade. In this connection other industries are complaining that the facts show that the French consumer is being made to pay more for coal, in order to allow owners to compete in the foreign markets at lower prices than are charged to the home consumer. An appeal is therefore being made for a reversion to the former state of things.

Protecting Household Coal Supplies.

The gas industry has for many years acted as the protector of the fuel supplies of the country in times of emergency. It will not therefore be without interest to its responsible men to learn that an attempt is being made by the railways and the coal merchants, in co-operation with the collieries, to safeguard the Metropolitan area from those spasmodic local coal famines which from time to time have been experienced as the result of causes which are not associated with labour disputes.

NATIONAL GAS COUNCIL.

A Meeting of the Central Executive Board of the National Gas Council took place on Sept. 13 at 28, Grosvenor Gardens, S.W. 1.

ELECTION OF CHAIRMAN AND VICE-CHAIRMEN.

Sir David Milne-Watson was re-elected Chairman of the Central Executive Board for another year.

The four retiring Vice-Chairmen—viz., Alderman F. S. Phillips, Mr. William Cash, Mr. J. H. Ellis, and Mr. F. H. Jones—were also re-elected.

PROPOSED GAS LEGISLATION.

It was reported that evidence had been given by Mr. Ogilvie before the National Fuel and Power Committee, on July 14, as to the statutory powers under which the gas industry operates at the present time, and the lines upon which the industry desires revision.

FINANCE ACT, 1927.

It was reported that, as the result of representations made to the Government, a new clause had been inserted in the Finance Act, 1927, granting statutory companies the same concessions as joint stock companies with regard to exemption from Stamp Duty upon amalgamation.

REPORT FROM JOINT TAR COMMITTEE.

A report was submitted from the Joint Tar Committee, giving a survey of the work undertaken by the Committee since its inception in November, 1924. It was agreed that a copy of this report should be forwarded to the members of the first Managing Council of the British Road Tar Association, which was to meet on Sept. 20. A vote of thanks was passed to the Joint Tar Committee and the Chairman, Mr. H. C. Head, for the valuable work that had been done.

BRITISH INDUSTRIES FAIR, 1928.

The Board unanimously agreed to the name of the Council being added to the patrons of this exhibition, and expressed considerable satisfaction that a Gas Section had been arranged. Representatives of the industry will be asked to support the project by arranging visits to the exhibition during the period from Feb. 20 to March 2, 1928.

RECORDING GAS CALORIMETERS.

It was reported that the Gas Referees were contemplating requiring the Metropolitan and some of the larger provincial gas undertakings to provide at least one recording gas calorimeter, to be brought into use for official testings as from Jan. 1 next.

BRITISH ENGINEERING STANDARDS ASSOCIATION.

A letter was submitted from the British Engineering Standards Association, inviting the Council to nominate representatives to attend a conference in October to consider the national adoption of standard methods of analysis of coal, as being of advantage to both the producers and the users of coal. It was decided that the Council should be represented at the conference, and that it should be suggested to the Institution of Gas Engineers that a Joint Committee be formed to consider the question.

PERSONAL.

Mr. R. H. BROWN, formerly of Birkenhead, has been appointed Gas Engineer and Manager to the Town Council of Johannesburg.

Viscount BURNHAM has been elected to the Presidency of the Incorporated Sales Managers' Association, in succession to Mr. J. M. Beable; and Mr. F. W. GOODENOUGH, Sales Controller of the Gas Light and Coke Company, has been re-elected Chairman.

Mr. R. M. HILL, B.Sc., of the Newcastle and Gateshead Gas Company, has been selected from a very large number of candidates for the position of Assistant Engineer and Chemist at the Ash Road Gas-Works of the Aldershot Gas, Water, and District Lighting Company.

Mr. NORMAN HUDSON, son of Mr. E. H. Hudson, Manager and Secretary to the Normanton Gas Company, has been appointed Engineer and Manager to the Mirfield Gas Company. Mr. J. W. TURNER, whose service with the Mirfield Gas Company extends over 57 years, has been retained as Secretary to the Company.

Mr. TYRELL W. SURMAN, of Rugby, has been appointed Manager of the gas undertaking at Ballymena, Co. Antrim. Educated at Maidstone Grammar School, Mr. Surman afterwards became an articled pupil of the Rochester, Chatham, and Gillingham Gas Company. Subsequently he became Chief Technical Assistant to the Isle of Thanet Gaslight and Coke Company, and latterly was Assistant Manager (with charge of works and control of labour) at the Rugby Gas-Works.

Recently in the Heywood Town Council, reference was made to the resignation of Mr. W. WHATMOUGH, Engineer to the Gas Department. The Council unanimously confirmed a resolution of the Gas Committee, expressing appreciation of his services, and determined to give him a testimonial under the corporate common seal. Mr. Whatmough has a record of over 50 years' service at Heywood, and for 38 years has been at the head of the Gas Department. His health is the reason for his retirement.

The approaching retirement of Mr. D. T. LIVESEY from the position of Engineer, Manager, and Secretary of the East Grinstead Gas and Water Company is reflected by the advertisement in another column for a successor. But the Company, we believe, are not to lose the counsel of their old chief officer. It is understood that Mr. Livesey will become a member of the Board. We wish our old friend long life and good health to enjoy the greater leisure and rest to which many years' of faithful service entitles him.

OBITUARY.

Mr. JOHN R. HARGREAVES, of Market Place, Haslingden, who died on Sept. 14, at the age of 69, was a master plumber up to his retirement. He was a Director of the Haslingden Union Gas Company for 21 years, Vice-Chairman for 11 years, and was appointed Chairman last December.

ELECTRICITY SUPPLY MEMORANDA.

THE infirmities of aged flex are causing some trouble to the electricity industry, and are making the public more intimately acquainted with the dangers of electrical current supplied at normal district voltages. They are being made aware that it is an agent of death which is not perceptible to the nose, eyes, or ears; and that to come into contact with it, frequently means the end of all things to the individual. Mr. G. Scott Ram has often called attention to fatalities from flex, the insulation of which has become impaired either by age or accident. The public Press have recently given prominence to two cases of death in which wireless apparatus and electric reading-lamps have been involved; and it has been proved in both that the reading-lamps and flex attachment have been the cause. In the case of the second one —at Newport, Mon. (which was noticed last week)—the Coroner expressed his opinion as to the duty of the suppliers of electricity inspecting the flexible arrangements in the houses of consumers. Whether they will take upon themselves that moral obligation remains to be seen. Following on the Newport electrocution came the publicity given to another case at a Forest Gate shop, where Albert Tomblin (aged 21) met with sudden death in the basement. A cry was heard. Another assistant rushing downstairs found Tomblin lying dead, clasping an electric light bulb attached to a piece of flex. The Manager switched-off the current (220 volts). It is thought that the man was attempting to unscrew an electric light bulb hanging over the sink, and that he was standing in a pool of water. Some of his fingers were burned, but not badly. Those are the simple facts. In this as in other cases, there was nothing to warn the victim.

Dangers of Flex.

Another Death.

Last Friday morning, Joseph Hopson was at work in the garden of Almond House, Church Street, Hampton, when he became entangled in some electric wires which ran across the garden, and was electrocuted. A woman engaged in the house heard the man groan, and called to her assistance some telephone men who were working near by. One of them used a rubber tobacco pouch to remove the wires from the body. Artificial respiration was tried; but, when a doctor arrived, he said the man was dead.

Other Fatalities and Troubles.

It is reported that Mlle. Cosette Gaillard, a Paris actress, met with her death on the 6th inst., through the metallic trimmings of her dress coming into contact with an electric wire at the theatre. She died later in the day in the hospital. At Cardiff Henry Bale, hearing cries at the rear of Newport Road, ran to the spot, and found a girl (aged five) in a garage with her hand on a wire, the insulation of which had worn bare. In releasing her, Bale must have touched the wire himself, for he died immediately afterwards. The girl escaped serious injury. A large house at Doncaster was partly wrecked by an explosion on the night of the 6th inst. It appears that the electric wires fused, and, we imagine, perforated the gas-pipes, for while the tenant's son and some companions were trying to repair the mischief to the wires, an explosion occurred between the ceiling of the dining-room and one of the bedrooms. Damage estimated at hundreds of pounds was done. Prompt action on the part of two Abertillery Council workmen averted what might have been a serious fire at the Brynhyfryd Council School on the 5th inst. The woodwork was found to be ablaze in the school; and the only attributable cause is the fusion of the electric light wire. The early discovery and a fire extinguisher enabled the two men to smother the flames. A refractory horse ended its days on the 5th inst. at the North Shields railway goods yard by bolting and falling across a double set of live rails. Just recently, Glyn Edwards (aged seven), of Llandudno Junction, caught his hand in an electric fan, and has had to have three fingers amputated. A hasty exit was made by the passengers from a L.C.C. tramcar in the Westminster Bridge Road on the night of the 5th inst. When opposite the entrance to Waterloo Station, flames suddenly burst from underneath the car, the seats and floor of which were damaged. The electricity supply at Plymouth failed last Saturday week, owing to an accident at the Armada Street sub-station. There was a short circuit; and the oil in which the transformer rested caught fire. There was an explosion; and the roof was fired and destroyed.

Suicide by Electrocution.

Accidental electrocutions have been fairly plentiful of late; but the newspapers tell us that now Prof. R. A. Lehfeldt, Professor of Economics at the Rand University, has pioneered electricity as an agent for committing suicide. He locked himself in his bathroom, chained his hands to the bath, and effected contact with the electric heater.

Paying for the Wiring.

In the getting of business by some municipal electricity departments, a considerable burden is sometimes placed on existing consumers by imposing upon them charges which they ought not to bear. From a report on the annual accounts of the Electricity Department of the Derby Corporation, we see there was a loss last year of £2688, as compared with a profit of £24,000 in the previous year. Smaller sales of current and the increase in the cost of coal account largely for the difference. During the year £9000 was transferred from the appropriation account to the relief of the rates; and to the same account there has been charged £17,000 —principally for meters. But, in addition—and this is an item to which we wish to call special attention—the wiring of the Corporation houses cost £6000 more than was charged to the Housing Committee. This sum has also been debited to the appropriation account, which, built up from the profits of previous years, has been reduced from £41,000 to £8000.

Differential Prices.

At the meeting of the North British Association of Gas Managers, Mr. J. Campbell suggested the construction of gas tariffs on the basis of differential prices for ascending zones of consumption, and that in the first belt of consumption there should be a "concealed service charge." Something very similar to what he proposes is the practice of the Sheffield Gas Company, and may be of other gas undertakings. It is a system that is fairly well known in the electricity industry, though two-part tariffs are the more popular, and are regarded as the more effective. It is probable, however, that the differential charge will come into more extended use when electricity is purchased by the distributing undertakings in bulk from the Central Electricity Board. An example of the sale of electricity at differential rates according to consumption is furnished by Hove; the current being supplied in bulk by Brighton. The charges are: Up to 10,000 units per annum, 5½d. per unit; the next 5000 units 5d. per unit; and the next 5000 units, 4d. per unit. All over 20,000 units at 3d. per unit. For power, heating, and cooking 1¾d. per unit is charged. This means that to obtain electrically 100,000 B.Th.U., or 1 therm, 29 units would have to be purchased, which at 1¾d. would cost 4s. 2¾d.!

Vapourings—Gas or Electrical?

Is there no member of the family of papers to which the "Electrician" belongs who can administer a little chastisement to it for its foolish references to the gas industry? It tells its readers that "the vapourings of those who interpret the opinions of the gas industry are never more ludicrous than when they demand that, because the Electricity Commissioners are achieving considerable success in extending the sale of electricity, there should be a corresponding propagandist Government Department for gas." When has the "gas industry" made this demand? An individual is not the gas industry, and is not, without authority, entitled to be so regarded. Our contemporary should not be silly even in misrepresentation. Another choice bit is: "They [the gas interests] also know that their industry can never stand on parallel lines with the electrical industry, any more than a horse or cart can be ranked as the equivalent of a mechanically propelled vehicle. Both have in their time [the writer does not say whether he is referring to the horse and cart and the mechanically propelled vehicle or the two industries] served a useful purpose, and both will doubtless find application, though in a continually decreasing field, for some time to come. The gas industry would be well advised to cut out the useless recriminations and its 'underground' propaganda methods, and make the best of the position as it is." Making the best of its position is just what it is doing. The Board of Trade returns show that last year the consumption of gas from the mains of statutory undertakings was 276,568·64 million c.ft., while in 1921 it was 229,077·1 million c.ft. By the way, we have heard the gas industry called a good many things, but never before has it been likened to a horse and cart; and the rate of expansion shows the simile is not a good one. In another part of the same issue, our contemporary quotes Councillor T. J. Lewis (we do not know who the gentleman is; he is certainly not a trustworthy authority) as saying: "Gas is as dead as the dodo; and in ten years' time, it will be almost impossible to find any town of any size where electricity has not ousted gas." The figures quoted above do not look as though we were extinct; if we were, there would not be any gas to oust during the next ten years. We wonder whether our contemporary believes this new prophet. If it does, what are the grounds for the belief; if it does not, why publish such nonsense?

When the Farmers Speak.

The farmers are sceptical as to any benefit being realized by them from the Government scheme, and yet the electrical people have been talking as though the one thing necessary for the salvation of the agricultural industry in this country is electric power. Mr. Borlase Matthews, M.Inst.E.E., has set himself up as the protagonist of electrical operation in agriculture; and Mr. Joseph Gibson, Ex-Chairman of the Notts. Branch of the National Farmers' Union, says that the protagonist is beating the air as a theorist, and many of his suggestions are impracticable. Mr. Matthews has brought upon his devoted head many criticisms from agriculturists for the attack upon their methods he made at the British Association meeting. They are the men who know what is required, and what can be done; he is the man who is the electrical apostle, and probably has never had the management of a farm. At the British Association meeting, he said that many farm duties were carried out just as they were a hundred years ago; and the remedy was the introduction of more machinery and electrical power. But according to opinions which have been gathered from many prominent agriculturists, the costs of equipment and power form an uneconomic barrier to electric development on the large scale. The farmers cannot see the use of finding capital for making a change which would not on balance lower their costs. It is their opinion that, while the work of the Central Electricity Board and Commissioners may reduce the cost of generation, the expense of getting it to the farmers will make electrical energy prohibitive for their intermittent work. From one quarter, it is stated that, to run an electrically equipped farm at a profit, the produce would have to be sold at three times the present price. That would not do. Another agriculturist says that some of the suggestions—apparently those of Mr. Matthews—are such as might have been expected from the humorous brain of Heath Robinson. What the farmers think of Mr. Matthews' ideas just about match what he thinks of their methods—and the farmers happen to be on the practical side of the fence.

FORTHCOMING ENGAGEMENTS.

[*Secretaries of Gas and Kindred Organizations are asked to assist in making this diary of events as complete and useful as possible by sending the earliest intimation of all meetings.*]

Sept. 22.—WALES AND MONMOUTHSHIRE DISTRICT INSTITUTION OF GAS ENGINEERS AND MANAGERS.—Meeting at Porthcawl.

Sept. 23.—SOUTHERN ASSOCIATION OF GAS ENGINEERS AND MANAGERS.—Visit to Hollacombe Works of the Torquay and Paignton Gas Company.

Sept. 30.—EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.—Annual meeting at Cambridge.

Oct. 3-5.—BRITISH COMMERCIAL GAS ASSOCIATION.—Sixteenth annual general meeting and conference at Southampton.

Oct. 27.—MIDLAND ASSOCIATION OF GAS ENGINEERS AND MANAGERS.—Autumn general meeting, Grand Hotel, Birmingham, at 2.30.

Nov. 17.—SOCIETY OF BRITISH GAS INDUSTRIES.—Autumn General Meeting at the Hotel Cecil.

INSTITUTION OF GAS ENGINEERS.

Oct. 10.—Emergency Committee.

Oct. 10.—Finance Committee.

Oct. 11.—Education Committee.

Nov. 15.—Public Works, Roads, and Transport Congress. Morning—Joint Session with Incorporated Municipal Electrical Association for discussion on "Street Lighting." Afternoon—Institution Session for discussion of "How the Gas Industry Can Assist Smoke Abatement."

Stream-Line Filter Company's Plants.

When reviewing on p. 612 of the "JOURNAL" for Sept. 14 the Shipping Engineering and Machinery Exhibition, reference was made to the interesting display of specialities of the Stream-Line Filter Company, Ltd., of 64, Victoria Street, S.W. The two plants that are likely to be of greatest interest to gas engineers are the "Stream-Line" separator for dealing with tarry effluents and removing from the water every trace of tar and oil, and the "Stream-Line" oil renovator for dealing with the used oil from gas engines. In connection with the latter plant, the Company have effected enormous savings in regard to the lubrication cost of Diesel and other oil engines, where lubricating oil represents 10 p.ct. of the whole cost of running. Although the cost of lubrication is not so high in connection with the gas engine, substantial savings are possible; and in one works where the Company have run a test with two 50 H.P. "National" gas engines, one of the small plants has, we are informed, paid for itself in the saving of lubricating oil in less than twelve months.

INSTITUTION OF GAS ENGINEERS.

Council Meeting.

A Meeting of the Council was held at No. 28, Grosvenor Gardens, Westminster, on Monday, Sept. 12, when there were present Mr. H. D. Madden, President, in the chair; and Messrs. W. H. Bennett, Harold E. Copp, L. J. Langford, W. Eames Caton, H. C. Smith, T. Carmichael, R. E. Gibson, R. Robertson, W. J. Smith, C. S. Shapley (Manchester District Institution), F. C. Briggs (Midland Association), H. H. Gracie (North British Association), T. Hardie (Southern Association), A. T. Kyle (Wales and Monmouthshire District Institution), and W. E. Price (Hon. Secretary).

Acknowledgments of their election to honorary membership were received from the respective Presidents of the German Association of Gas and Water Engineers, the Swedish Gas Association, and the Swiss Association of Gas and Water Engineers.

A letter was read from the Institution of Civil Engineers conveying the acknowledgments of their Council for the way in which the Institution of Gas Engineers have co-operated in the work of the Heat Engine Trials Committee, which has now concluded its report. Messrs. C. Rhodes Armitage, W. Newton Booth, Harold Hollings, and E. W. L. Nicol, the representatives of the Institution on this Committee, were thanked for their services.

Consideration was given to the preliminary arrangements for the annual meeting to take place at Cardiff next year; the dates decided upon being June 12 to 15. A civic welcome is to be extended to the members; and, in addition to the programme of papers and reports of research committees, visits to various works will be organized.

The following were approved as candidates for the class of Member: Mr. Frank Blackburn (Devonport), Mr. William Hawkyard (Tottenham), Mr. William Millar (Cookstown), and Mr. Jeptha Neath (Staines); for the class of Associate Member: Mr. Edward C. LeJune (London).

Mr. Frank Greenhalgh (Oldham) and Mr. John W. Pallister (Middlesbrough) were transferred from Associate Member to Member; and the following were admitted as Students: Messrs. James M. Brown, B.Sc. (Leeds), Charles F. Petersen (Bournemouth), James J. Priestley, B.Sc. (Leeds), and Frank W. R. Santler (Malvern).

Sympathetic reference was made to the deaths of Mr. Frank W. Bottle (London), Mr. P. W. Cooke (Kingston-on-Thames), Mr. Robert Fish (East Cowes), Mr. James Lees (Tonbridge), and Mr. John T. Sheard (Sheffield) which had been notified since the last meeting.

A legacy of £100 was announced from the late Mr. Daniel Irving, Past-President of the Institution, which it was resolved to invest on behalf of the Benevolent Fund, in which he had taken a great interest for many years.

The revised rules of the National Illumination Committee of Great Britain (affiliated to the International Commission on Illumination), on which the Institution is represented, were submitted and approved. The resignation of Mr. J. G. Clark from this Committee was accepted with regret, and a vote of thanks was recorded for his services. Capt. W. J. Liberty was appointed as his successor.

It was resolved that the patronage of the Institution be accorded the Gas Industries Section of the British Industries Fair, which is to be held at Birmingham from Feb. 20 to March 2 next.

The President for the time being was nominated to represent the Institution on the Council of the Institute of Fuel.

Mr. W. J. Smith was appointed to serve as representative at a conference on methods of coal analysis which the British Engineering Standards Association propose to convene next month in response to an official request from the Committee of the Privy Council on Scientific and Industrial Research. The question of the adoption of Report No. 7, "Methods of Analysis of Coal," as drawn up by the Fuel Research Board is to be considered.

Assent was given to an exchange of publications with the Danish Association of Gas Engineers.

The report of the Finance Committee was presented, accepted, and adopted.

At the conclusion of the meeting, the Council proceeded to Olympia for the official visit of the Institution to the Shipping Engineering and Machinery Exhibition.

Reports of Inspectors of Mines.—The issue by the Mines Department through H.M. Stationery Office is announced of two reports for 1926 of Inspectors of Mines. The first is that of Mr. John Masterton, Inspector in Charge of the Scotland Mines Inspection Division, which covers the whole of the mining and quarrying industries throughout Scotland. The other is by Mr. T. Greenland Davies, who is in charge of the inspection of mines and quarries in the Northern Division. This Division includes the whole of the Northumberland and Durham coalfield, the Cleveland ironstone district, and the coal and ore mines of Cumberland, Westmorland, and North Lancashire, and the Isle of Man. Each report, 1s. (post free 1s. 1½d.).

NORTH BRITISH ASSOCIATION OF GAS MANAGERS.

DISCUSSIONS ON PAPERS.

In the "JOURNAL" last week, the report of the general proceedings at the annual meeting of the Association was published, together with the "William Young Memorial Lecture," by Dr. E. W. SMITH, and the papers on "Methods of Charging for Gas," by Mr. JAMES CAMPBELL, of Dunfermline, and on "Gas Blending," by Mr. ROBERT STURROCK, of Ardrossan. To-day we give the report of the discussions on the papers.

Discussion on Mr. Campbell's Paper.

The PRESIDENT (Mr. James Bell, Dumbarton) said the author was to be congratulated on the broad views and simple principles which he propounded.

Mr. H. H. GRACIE (Edinburgh) remarked that this was a subject which was very much in the forefront at present. He would, however, like to make the general statement that the industry should be very cautious at this critical juncture about launching any scheme which might alienate the sympathy of its customers. Gas supply was a public utility service, and carried with it many obligations. Any change in the method of charge would probably require alterations in the Parliamentary Acts which prescribed that any party applying for gas must be supplied if the premises were within a certain distance from a main. There was the further condition that so much of the service pipe could be charged for. Provision also was made for the quantity and value of the gas which had to be consumed, and for security for payment. The question, therefore, arose in his mind whether they were not protected by this against the very small consumer, and whether, in the case of stand-by supplies, a charge for the service pipe and meter did not meet the case. The more complications they introduced, the more costly they made their internal working arrangements. It might necessitate scrutiny and adjustment of charge of every individual account. The simpler they could keep the method of charge, the better for the industry and for fostering the goodwill of consumers, many of whom were already mystified by the therm. Further complications would give competitors another text on which to create a campaign. Mr. Campbell argued that by his system the large consumer should gain considerable concessions in price. In many towns already the large consumer got such concessions in the form of discounts and rebates. The system of giving discounts and rebates for larger consumptions and quick payment was a recognition that the small consumer must pay more. Would it not be wiser to develop along such lines, rather than to introduce a new factor? The industry had advanced and prospered on the old lines, which fact must indicate that they were fairly sound, and were considered as being fair by the community. Looking at the average cost of collection, meter reading, &c., as set forth in the paper, he was not sure that it was fair to take the average charge as applying to all small consumers, because they might be prompt payers. It was the slow payers who ran up the costs. Mr. Campbell was right when he said there would be strenuous opposition to the service charge; but was the final solution to be the introduction of a "hush, hush" policy? He (the speaker) thought they must be frank in all their dealings. Accordingly, he would ask Mr. Campbell to consider withdrawing these remarks from his paper before it was published, as he feared they might create a wrong impression. With regard to the industrial consumer, a plea in favour of a reduced rate was that he could take his gas in approximately equal weekly quantities and during the daytime. Such a consumer was, therefore, not adding to the peak load at the heaviest season of the year. There was a large field among these consumers for new business if an attractive price could be quoted. As for the consumer introducing extra appliances, was there not every possibility that a change of meter or a larger service pipe would be necessary, involving additional capital? In America publicity campaigns had been found necessary to boost their new methods; but would not such campaigns have the effect of dividing the consumers in this country? The comparison with the telephone charges was hardly in keeping with the latest proposal. The telephone was a monopoly. It was under one control—the Government—and there was no competition. Mr. Campbell had referred to Toronto, and the reduction in non-profitable consumers to 10 p.ct. This seemed to be much the same percentage as Dunfermline had now. Consequently, was there much advantage to be gained? At the same time, 10 p.ct. of very small consumers was high. If one consumer who used as much gas as 1100 smaller consumers was lost, his withdrawal would be a blow which it would take considerable expense to make up. But it must be remembered that one was not likely to lose 1100 consumers at once. They had to consider the propaganda, experiment, canvassing, and other expenses that must necessarily be involved before the large consumer was secured. It occurred to him that among these 1100 small consumers there was an excellent field for publicity and propaganda work with a view to increasing their demand and getting them on to a remunerative footing. They must bring down the price of gas, so that its use became a decided financial benefit to the consumer. If this were done, they were bound to get increased business. In Edinburgh they got out a statement some time ago showing the number of consumers using different quantities. This was done with a view to preparing a graduated scale. They found, however, that this would affect a large number of consumers adversely, so they had delayed the matter for further investigation. In connection with new supplies, they ascertained whether the new capital would be remunerative. If they found it would not be, then they asked the prospective consumers to guarantee a consumption of 20,000 c.ft. or more per annum, in order to justify the expenditure. This guarantee was asked for in addition to payment for extra lengths of service pipes. In the Edinburgh area this system had worked very well.

Mr. JAMES RICHMOND (Penicuik) remarked that it was not the flat rate that was unsatisfactory. It was the system whereby charges were not spread over the consumers in proportion to the capital cost of each consumer. It was not fair that the industry should pander to very large consumers just for the reason that an additional sum could be produced by the manufacture of extra gas. If they did so, then it was at the expense of other customers. There must be no "concealed charges;" and he was glad to hear from Mr. Gracie that he was not a believer in that method of working.

Mr. DAVID VASS (Perth) said he failed to follow Mr. Richmond's argument. At one time he was standing out for a flat rate, while a moment later he was practically an advocate of what Mr. Campbell was urging. In Perth, with a view to encouraging the day load for industrial purposes, they had applied a reduced scale. It seemed to him that they could effect an improvement on the present system of charging if they fixed a maximum rate for the first 10,000 c.ft., or even 20,000 c.ft., per quarter. A lower rate could afterwards be introduced step by step. In Perth his minimum industrial rate was 45 therms per meter per quarter.

Mr. SCOTT (Cowdenbeath) took the view that the proposals embodied in the scheme outlined by Mr. Campbell were eminently suitable for adoption. If they took their everyday experience, they found that the consumer who used 20,000 to 25,000 c.ft. of gas per annum regarded himself as a regular consumer, and was entitled to a rebate. The author had proved successfully that a substantial reduction above a given figure (say, 20,000 c.ft. a year) could be introduced.

Mr. GEORGE KEILLOR (Greenock) observed that six or seven years ago they interested themselves in this subject in Greenock; and he had some good friends in America and Canada with whom he was in correspondence. The main point of that correspondence was to find out if anything that was going on there was suitable for Scotland. When he investigated the problem, he realized that in this country their methods of charging for gas were wrong. If they were to put in operation a service charge, every consumer, big and little, would have to pay that charge; and this would immediately take something off the price of gas. They desired to sell gas at the lowest possible figure. He thought the time was coming when they would have to abandon the idea of free cookers. At the earliest possible opportunity they ought to adopt the principle of charging for gas advocated by Mr. Campbell. In Greenock, to render the small consumer more profitable to the undertaking, they charged them more for the gas than they did to those who burned more of it. To a considerable extent they had what Mr. Campbell mentioned —a "concealed charge."

The PRESIDENT remarked that Mr. Richmond appeared to be opposed to the general principle of reducing the charge to the larger consumer. He would remind Mr. Richmond that the large consumer in the average gas undertaking was the best paying one. If they wanted to encourage the best-paying consumer, then they had to give him some concession. They ought to adopt a sliding-scale charge.

Mr. JAMES CAMPBELL, in reference to Mr. Gracie's dislike of the term "concealed charge," said that he himself did not like the term. He had used it merely because he could not find a better one.

The PRESIDENT, in closing the discussion, said they were much indebted to Mr. Campbell for his paper. The contribution would help those who were contemplating new methods of charging. Personally, he was a great believer in the principle of differential rating.

Discussion on Mr. Sturrock's Paper.

The PRESIDENT said he had no doubt that the methods described in the paper would interest many gas managers in Scotland. The question of dilution was one that had been uppermost in the minds of gas managers for many years. He believed in blending by legitimate means—*i.e.*, by water gas. There was sometimes the fear that a "blended" gas would adversely affect meters and services. The author had shown how this difficulty could be overcome. In certain circumstances the blending of coal gas with blue gas might prove a paying proposition. Sometimes the coke market was adverse to the production of blue water gas, but there were other occasions when it might prove advantageous to gasify coke. He thought, however, that generally it did not pay to produce blue water gas for dilution purposes.

Mr. H. H. GRACIE (Edinburgh) remarked that Mr. Sturrock had not told them why he had changed from 550 to 450 B.Th.U. The author was to be congratulated on the very small moisture content of the coals. Many gas managers in Scotland would be pleased if they got only 4 p.ct. of moisture and 2·7 p.ct. of ash.

Mr. JOHN WILSON (Motherwell and Wishaw) explained that he saw the "Simplex" plant some time ago at Ardrossan. For a small works, the plant operated well.

Mr. C. W. FAIRWEATHER (Kilmarnock) spoke of the difficulties introduced when the gas had a high moisture content.

The PRESIDENT observed that the question of moisture in gas was one of great importance. Possibly they would soon have some valuable communications from the Institution of Gas Engineers regarding means to be adopted for the removal of moisture.

Mr. STURROCK, referring to the point raised by Mr. Gracie about the low moisture content of the coals carbonized at Ardrossan, thought they were no better than those which could be obtained easily in the Scottish coal market. With mixed gas at Ardrossan, they had experienced no difficulty with purification. The condensers at the

works were capable of dealing with much more than was required of them at present.

SOCIAL ENGAGEMENTS.

In connection with the meeting of the Association, there were several interesting social engagements. These included a reception and dance on the Thursday evening, when the members and their lady friends were the guests of the Provost, Magistrates, and Town Council of the Royal Burgh of Dumfries. Provost O'Brien, who was accompanied by the leading civic dignitaries of the town, extended a cordial greeting to the visitors. A motor drive was enjoyed on Friday—the day following the meeting—when the route covered was by way of Moniaive, Dalry, Castle Douglas, Kirkbean, and Newabbey. Other functions on the programme were golf and bowling competitions. Results of the former were published in last week's "JOURNAL."

THE REINFORCED CONCRETE TANK FOR GASHOLDERS.

By A. GADD.

Whatever the present-day experiments in tankless gasholders may ultimately lead to in this country, the adoption of the tank itself is yet too extensive to allow considerations regarding it to be overlooked or neglected.

In the issue of the "JOURNAL" for Nov. 4, 1925, I showed that the stresses, tensile or compressive as the case might be, across the thickness of the tank wall below ground-level were of a variable nature, and greatest at the inner face thereof; but for proportions common to industry, an average resultant stress could be assumed with safety, and calculations correspondingly simplified.

With regard to reinforced tanks of concrete situated above ground-level, and therefore free from external pressure of backing, it appears to be rightly taken for granted that the stresses are, for practical purposes, uniform across the wall thickness—though this assumption must be confined to tanks of large diameters, but which are not abnormally deep.

When, however, it is also supposed that the tank wall will be entirely relieved of tension by the insertion of reinforcing bars of metal (such supposition being based upon the uniformity of stress named), considerations arise which tend to refute such an idea. It fortunately happens, in this sense, that the cost of construction and upkeep are against abnormally deep tanks; otherwise conditions would arise with which it might be difficult to deal.

The indisputable fact is that, if the internal pressure within the tank per unit area exceeded the tensile strength of the material composing it, the concrete tank would be ruptured, no matter how thick its walls were. This means that rupture, instead of tending to take place over the whole section of the wall at once, would, given pressure enough, *commence* at the inner face of the aforesaid wall, and tend to spread outwardly through the thickness thereof, somewhat after the manner indicated in fig. 1. That is to say, the small initial break shown would extend outwardly according to the broken lines indicated.

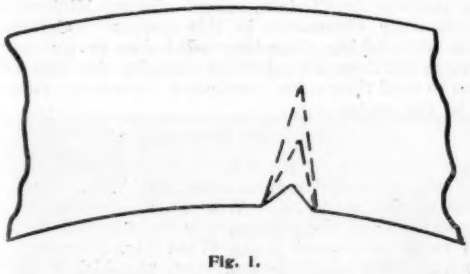

Fig. 1.

It is absurd to suppose that this tendency to tension at the face to be unaffected by the strength of the wall elsewhere or is confined to any particular pressure applied; it is also important to note that the kind of rupture referred to does not involve a tendency of a mass to turn about some neutral axis. Therefore the problem is not that which occurs (say) in the breaking of a cantilever under load, for relieving tension in which the introduction of reinforcing bars is a successful expedient.

In fig. 2 a vertical section of a portion of a wall of a tank in concrete, with a line only of reinforcing bars therein, is indicated merely; the right-hand edge of the figure being assumed to represent the line or trace of the inner face of the tank.

It is generally assumed in problems of this character that each sectional area of a bar takes up or resists the tension all over the particular area of concrete around it; suchlike areas being here shown by broken rectangular lines.

But for the reason already given, with reference to fig. 1, not even the bar, marked *b*, which is nearest the inner face

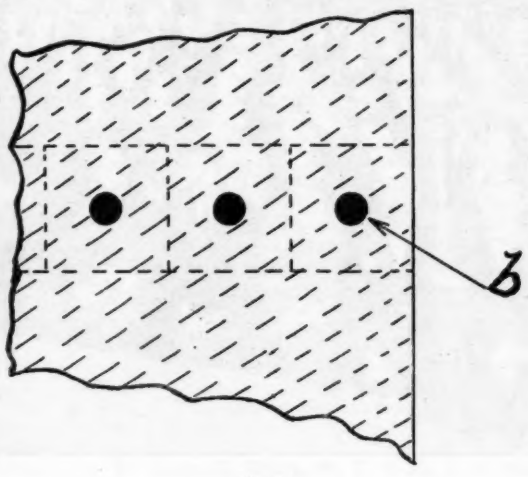

Fig. 2.

of the tank wall (fig. 2) is called upon, so to speak, to offer resistance when rupture or tension *commences* at the face mentioned—so far as this surface tension is concerned, which is the only tension at present under discussion.

It might be suggested that reinforcing the actual face of the tank would relieve the situation; but practical difficulties as to requisite adhesion between concrete and metal arise here. The tensile strength of concrete is admittedly low, but it is fortunately sufficient to prevent rupture, and safely so, under the conditions of diameters and depths of tanks, and weights of liquids therein, at present in vogue.

Where there is an operating pressure acting inwardly, as in the case of tanks below ground-level, such pressure directly reduces, and generally obliterates, the tension at the inner face concerned; and if it were possible to introduce, in place of inert bars or rods within the wall, rods which were positioned under tension, before the concrete was poured into the forms, then this initial tension would operate to reduce that due to internal pressure upon the tank—after the manner, but in a far less degree, of tubes shrunk upon each other in ordnance construction of more or less past days.

This provision of a moderate amount of initial tension in the rods, to counteract the tension at the *surface* of the tank, would mean that forms and centering employed would have to be exceptionally strong and rigid for the purpose, and be retained until the concrete, layer by layer, was equally strong in setting, to resist the crushing stresses so introduced therein. But the attainment of this, according to present-day practice, may not be a feasible proposition.

It is at any rate worthy of note that the remarks so far made show, on the one hand, that there is a limit to the depth of a tank free from external pressure and containing a heavy liquid, and, on the other hand, that present methods of reinforcement with inserted bars fail to relieve the surface tension of a concrete tank situated above ground-level.

Ethylene for Ripening Fruit.

The manufactured gas industry, says the "American Gas Journal," has recently added to its list a new form of service having nothing to do with heat. Fruit and vegetables can be stored green and ripened at will, or can be picked before maturity and ripened naturally, by the use of ethylene, according to experiments made by Dr. R. B. Harvey, of the Minnesota College of Agriculture. Ethylene has been used as an anæsthetic; but its application to fruit and vegetables to increase their respiratory rate, and so induce a natural ripening process, is a recent development. Practically all important fruits and vegetables of the tropical and temperate zones have been successfully treated. The only equipment needed, says Dr. Harvey, consists of cylinders of ethylene and a reasonably gas-tight chamber in which a temperature of 65°-70° is maintained. Ethylene is permitted to flow into the chamber (in which the fruit is placed) at a rate determined by experiment.

GAS SALESMEN'S DAY.

Fifth Annual Meeting in London.

There was a large and enthusiastic audience, drawn from north, south, east, and west, in Caxton Hall, Westminster, last Friday morning, Sept. 16; the occasion being the fifth annual meeting of members of the Gas Salesmen's Circles. The chair was occupied by Mr. F. W. Goodenough, C.B.E. (Executive Chairman of the "B.C.G.A."); and he was supported on the platform by Mr. W. M. Mason (Manager of the "B.C.G.A."), Mr. J. C. Walker (General Secretary), and the various District Chairmen.

CHAIRMEN'S STATEMENTS.

As is customary on these occasions, the opening remarks of the Chairman were followed by brief statements by the Chairmen (or their deputies) of the different Circles on the work that has been accomplished in their respective districts. This proved an invigorating portion of the proceedings; for the tale that was told was a pleasant one. From every direction the report was the same—undiminished enthusiasm, and a sturdy belief in the ability of the Circles to continue doing good work such as they have already accomplished. There were from one and another practical suggestions for increasing the usefulness of the Circles; and these readers will be able to study when the verbatim report of the proceedings appears in the forthcoming issue of the "GAS SALESMAN."

APPEALS TO THE YOUNGER MEMBERS.

One point that will strike those who consult the report is the appeal that was made to those who have not already done so to take an active part in the proceedings of their particular Circles by reading a paper or joining in the discussions. It may be that "they also serve who only stand and wait;" but, in connection with Gas Salesmen's Circles, it is evident that there are more valuable ways of rendering service than by standing aside the whole time while others are left to do all the talking. Salesmen need confidence in themselves; and one way of gaining it, they will find, is by getting on their feet and "saying something at the Circle meetings." In making this appeal, Mr. E. L. Oughton did so from both the Circle and the individual points of view. "If," he said, "there is to be evidence of life in any association, this evidence must be forthcoming from the individual members. There are many members who come to the Circles with the idea that if they regularly attend the meetings they have done their part. They have not done their part at all. Mere acquiescence in what is said is not sufficient. It is an active share in the proceedings that is called for. . . . We must infuse into the younger members this desire to take an active part in the proceedings; for apathy leads to paralysis and death, and we do not want that." Referring to this, Mr. Goodenough instanced the practice of a debating circle of which he is a member. This is for the chairman to ask each member in turn whether he wishes to say anything on the subject under discussion.

The younger members were also the object of an appeal by Mr. W. L. S. Spinks, who referred to the desirability of engineers and managers sending the younger members of their selling staffs to the Circle meetings. In the Midlands he finds great diversity of custom in this respect. Certain of the smaller undertakings regularly send five or six men to the meetings; but there are others of a similar size who seem quite content to send their sales manager or showroom manager, and there let the matter rest.

SCOTLAND PERSEVERES.

These references to the Chairmen's remarks may be concluded with a quotation from what Mr. A. B. Munroe, of the Scottish Circle, had to say. Without, it is hoped, being in any way controversial, the opinion may be advanced that the quotation explains a good deal. What Mr. Munroe said was: "We had seven meetings last year, at which the attendance averaged 38. That is 'good going,' when you bear in mind the fact that some of these enthusiastic members come from as far away as 30 miles, and that, owing to the lack of railway facilities, the return journey has to be made up of 20 miles of railway travel and 10 miles walking." One can heartily agree with the speaker that "while such enthusiasm is maintained the success of the Circle is assured."

AN UNCONVENTIONAL VIEW OF BUSINESS.

The principal feature of the morning's proceedings was an inspiring address by Mr. E. Ernest Hunt, a Master of St. Paul's School, London, who discussed what he regarded as "an unconventional view of business"—though at the conclusion of the address Mr. Goodenough pointed out that there are to-day more who will take the view enunciated by Mr. Hunt than is generally recognized by those who think of business as being conducted in the manner expressed by that old phrase "business is business."

The address was not one which lends itself to summary; and therefore readers must wait for the full report which will be published in the "GAS SALESMAN." Some brief indication of the line adopted by Mr. Hunt will, however, be gathered from the following

Short Synopsis.

WHAT IS BUSINESS? Two people met together over the goods, commodity, &c. Essence being that there is a human being at each end—working through Mind; therefore the study of Mind.

WHAT IS MIND? Dual in working, conscious and subconscious, exterior and interior, intellectual and emotional, head and heart, the self and the soul. Both these sides of Mind need sustenance.

BUSINESS IS USUALLY INTELLECTUAL—which is a great cause of dissatisfaction—the emotions are cut out, the human element neglected. But all workers have emotions, so have business men, and so have customers; it is not enough to satisfy the intellect. The problem is how to get this emotional element back into business. The answer is in

SERVICE—fundamental in all business—the practical expression of the law of Love in its greatest sense—a law of our existence, exemplified in gravity, cohesion, chemical affinity, &c.; a force of attraction which holds things together. Its opposite would lead to wholesale destruction.

BUSINESS AND LIFE. Memory the *crux*. Life is a bigger thing than business, and business must minister to the greater issue. Regarded in this greater light, it builds character—which is eternal.

Perhaps the spirit of the meeting may be best summed-up in the statement that the address was enthusiastically received, and that the lecturer was as pleased with his audience as the audience were with their lecturer.

VISITS.

Of no less value than the morning's business were the afternoon's proceedings, which comprised a series of visits arranged through the kindness of the Governor and Directors of the Gas Light and Coke Company. These were to the Fulham meter and stove shops (an illustrated description of which will appear in the "GAS SALESMAN"), to Watson House, and to a choice of the Kensington, Kilburn, or Walham Green showrooms.

In every respect it was a profitable day.

INTERNATIONAL COMMISSION ON ILLUMINATION.

MEETINGS OF EXECUTIVE AND TECHNICAL COMMITTEES, BELLAGIO, ITALY, AUG. 31, SEPT. 1-3.

[COMMUNICATED.]

It was provisionally decided at the Geneva Conference of this Commission, three years ago, to hold the seventh triennial session in the United States of America. In consequence, however, of the facts that the International Electrotechnical Commission had arranged for a conference in Italy in the autumn of this year, and that this would interfere with attendance of many members at the proposed session of the International Commission on Illumination, it was decided to postpone the latter for twelve months.

The presence in Italy of many who are members of both Commissions afforded, however, an excellent opportunity for the furtherance of the work of the various Technical Committees appointed at Geneva, and at the same time for the consideration by the Executive Committee of important proposals which had been advanced. A series of meetings of these bodies was accordingly arranged to precede by a few days the session of the Electrotechnical Commission, which had been fixed for the first part of September in Bellagio, on Lake Como. These were likely not only to expedite work for the next plenary session of the Illumination Commission, but to give some chance to the National Illumination Committees of Germany, Belgium, Holland, and Japan, which had joined since the Geneva Congress, to take immediate part in the programme of investigation.

The work delegated to Sub-Committees at the Geneva Convention covered the ground of heterochromatic photometry, definitions and symbols, factory and school lighting, automobile headlights, vocabulary, and colorimetry, with a proposal that the various National Committees should take into consideration the question of street lighting. These subjects, with any others desired, were placed on the general agenda for the meetings at Bellagio, and arrangements made for conferences of all the delegates present on matters of general policy and the future work of the Commission.

The meetings were convened for Aug. 31 and Sept. 1, 2, and 3, and were held at the Hôtel Grande Bretagne, Bellagio. The proposals were well received by the various National Illumination Committees, and a large number of delegates attended. The conference was favoured by exceptionally fine, if hot, weather; the district being bathed in glorious sunshine.

DELEGATES WHO ATTENDED.

The list of delegates present must be regarded as representative, and was as follows:

Italy.—MM. Bordoni, C. Montu, Ferrario, E. Sospisio, G. Via, G. Bisazza, M. Bohm, C. Clerici, S. Danesi, M. Muggia, L. Pello, G. Peri, C. Puccioni, G. Sartori, and E. Vianello.

Great Britain.—Messrs. K. Edgcumbe, E. Rayner, H. Buckley, P. Good, L. Gaster, C. C. Paterson, J. W. T. Walsh, L. B. W. Jolley, E. Willis, W. E. Bush, J. A. Macintyre, and R. Watson.

France.—MM. J. Chappuis, P. Janet, Blondin, Jouaust, Leblanc, Maisonneuve, Wetzel, Imbs, Sartre, De Valbreuze, P. Fleury, F. Cellerier, M. Bailly, and M. Gouffé.

Germany.—MM. Meyer, Bloch, Dziobek, Pirani, Wissmann, Teichmuller, and Gehrcke.

Switzerland.—MM. Joye, A. Filliol, E. Payet, F. Largiader, W. Trub, F. Tobler, and Ed. Binkert.

U.S.A.—Messrs. E. P. Hyde, C. H. Sharp, F. Meyer, A. E. Kennelly, L. M. Marks, and S. G. Rhodes.

Austria.—MM. Koch and Kremenczky.

DELEGATES TAKEN IN FRONT OF HÔTEL GRANDE BRETAGNE, BELLAGIO.

Japan.—M. Kan Tanaka.
Holland.—MM. Halbertsma and Feldmann.
Belgium.—M. M. Vink.
International Bureau of Labour.—Dr. Carozzi.
U.S.S.R.—M. Chatelain (as observer).

OFFICERS OF THE COMMISSION.

The officers of the Commission were: Dr. Hyde, President; Col. Edgcumbe, M. Rouland, and Sig. Semanza, Vice-Presidents; Mr. C. C. Paterson, Hon. Secretary and Treasurer; and Dr. J. W. T. Walsh, General Secretary. M. Rouland was unable to be present. Sig. Semanza could not through illness attend the meetings, but happily found himself able to put in an appearance at the last meeting of the delegates.

The Executive Committee had a busy time; and their two sittings at the beginning and end of the conferences were characterized by agendas which occupied many hours. The time, 3½ days, provided for this and the Technical Committees was by no means too great. Meetings to be held simultaneously had been already arranged in view of the number of subjects and of the numerous reports and papers which were to be submitted. The addition, during the course of the sittings, of further contributions made, therefore, adequate discussion difficult, and lessened its potential value. The belated contributions, apparently with little notice, must have caused the General Secretary, Dr. Walsh, and his Assistant, Mrs. Buckley, some concern; and they deserve considerable credit in the performance of their tasks.

The plenary session in 1924 was in one sense noted by the large number (about thirty) of papers submitted; but though the meeting at Bellagio was essentially one for advancing the work undertaken by the various Technical Committees, it seemed to be regarded as a quasi-plenary conference with its opportunity of papers in even greater numbers than at Geneva. One must confess to disappointment in that some of the subjects failed for lack of time to obtain the full attention they deserved. Nevertheless, the work done generally justified the gathering, and certainly advanced the consideration of subjects to be dealt with at the plenary conference to be held next year. The delegates from the four countries which have recently joined the Commission thoroughly associated themselves with the work in hand, and with the opportunity afforded became fully conversant with the problems on the immediate programme of the Commission.

GENERAL PROCEEDINGS.

After the preliminary meeting of the Executive Committee, the general proceedings opened with a conference of all the delegates. A cordial welcome to Bellagio was given by the Potestà, or Governor of the Town, which was suitably acknowledged by M. Janet.

Dr. Hyde, the President, in his opening remarks, explained the purpose of the meeting, and welcomed the representatives of Germany, Holland, Belgium, and Japan, and also the unofficial delegate from Russia. He expressed appreciation of the hospitality of the Italian Illumination Committee, the members of which had arranged for the gathering in Italy, and further commented on the value of the technical work done by them. He stated that his term of office as President had expired, and it became expedient that a new leader should be appointed—one who was more actively in touch with the varied fields covered by the Commission than he could be in his retired life.

In dealing with the procedure at that meeting, Dr. Hyde stated that the reports and papers would be presented with only a few words of introduction, since their previous perusal was assumed.

Dr. Clayton Sharp then briefly introduced proposals which had been made by the U.S.A. Illumination Committee as to the future and increased activity of the Commission. He said that there was need for international consideration of illumination problems directed towards advancement of the science and art of illumination; and in this, all interested in the production and application of light, in physics, in the conservation of vision, and in commerce should join. Progress in all branches must be translated into public service, and co-operation for the furtherance of their work in matters of illumination was necessary. To that end the programme of work should be comprehensive and prosecuted vigorously.

The U.S.A. Committee submitted a tentative list of topics which might be considered by the other National Committees before the next plenary session. The list consisted of the following subjects, each of which had a number of sub-divisions; Standards and Units; Nomenclature; Vision; Colour; Photometry; Testing; Artistic Aspects; Production of Light; Optics; Illuminants; Lighting Equipment; Lighting Economics; Light as a Factor in Accident Prevention; Lighting of Interiors; Exterior Lighting; Codes and Regulations for Factories, Schools, Motor Vehicles, and others; Organization of the International Commission; and Organization of National Committees.

The proposals had already been circulated; and Dr. Sharp was followed by Col. Edgcumbe, Prof. Bordoni, and M. Janet, who respectively submitted the comments of the British, Italian, and French Committees. These were in general agreement with the proposals outlined, as were those subsequently expressed by delegates from other countries.

Col. Edgcumbe referred to the constitution of the British Illumination Committee, which covered the Institution of Electrical Engineers, the Institution of Gas Engineers, the Illuminating Engineering Society, and the National Physical Laboratory. He stated that membership had been extended to cover other national organizations which were directly or indirectly interested in the practical work of the Commission. Such extension had already been found useful; and he recommended the same course to the other National Committees.

Reference was made by the Italian delegation to the fact that in some countries, as in Italy, lighting by gas had become of very little importance, so much so that the Committee had virtually transformed itself into one of "Lighting and Heating;" and a plea was advanced for some inclusion of the latter work in the programme. The President, however, stated that gas lighting only, and not gas as such, was within the province of the Commission, and that it was only in certain countries that any consideration of heating subjects had been undertaken.

It was pointed out by Mr. C. C. Paterson that the programme of the American Committee involved work for many years, but there were problems ripe for immediate study; and for these the Executive Committee had been considering the advisability of delegating important and specific subjects to the various National Committees, which would be asked to undertake them, and to act as secretariats in connection with same, collaborating and collecting information from the other constituent countries. This would probably be better than the present method of appointing Committees with one or more representatives from each country. He suggested that if the proposal were adopted, a small Committee of the delegates should then be appointed to make the selection of important subjects and to allocate the required work to definite countries. This was agreed to.

Reports by the French Committee on the black body standard of light, the comparison of samples of diffusing glass, and the study of glare were on the agenda for this meeting; but, following the submission of the first by M. Janet, these were referred to various Technical Committees for consideration.

The British National Committee then submitted the "B.E.S.A." Standard Specifications for street lighting, electric lamps, and portable photometers; and these were similarly referred to Sub-Committees of the Commission for subsequent report.

Mr. Paterson stated that the Executive Committee had decided to invite the National Laboratories of those countries where such existed to help, through their photometric experts, in matters of illumination standards and units, with a view to extended international agreement. The meeting then adjourned until Saturday.

MEETINGS OF THE TECHNICAL COMMITTEES.

The following days, Thursday and Friday, were devoted to the meetings of the several Technical Committees. These bodies, appointed at the Geneva Conference, consisted respectively of representatives, usually one in each case, from each of the countries on the Commission, and therefore were not in themselves large. It was permissible, however, at Bellagio for any of the delegates to attend and speak at meetings in which they were interested, though they were not entitled to vote should decision be required. Advantage of the opportunities was freely taken, and the gatherings were well attended.

Thursday morning was occupied by the two Committees on Vocabulary, and Factory and School Lighting. At the first, a report of progress was made by the Chairman, Prof. Joye (Switzerland), and was followed by the submission of various proposals and papers by the British, French, and Italian National Committees. The British Committee were able to present a standard glossary of terms used in illumination and photometry, prepared in this country and issued by the "B.E.S.A."

At the other meeting, under the chairmanship of Mr. L. B. Marks, an account was given of the work done in the U.S.A. on the codification of illumination values required for factory and schools and of the progress made in their adoption by various States. This was followed by useful information of practice in other countries embodied in reports on papers from France, Italy, and Switzerland, and in verbal statements by a number of the new delegates. The discussion was such as to necessitate a later meeting of this Committee.

The Technical Committee on Definitions and Symbols met in the afternoon, and considered a report by M. Janet on behalf of M. Blondel, who is the Chairman, and the proposals or comments by the French, German, Italian, and British bodies.

The question of heterochromatic photometry was also discussed by its particular Committee in another room; several

reports being presented. The subject of colorimetry was on Friday's agenda for the consideration of another Committee; but the meeting on this occasion was cancelled.

An interesting meeting on automobile headlights took place in the morning, under the presidency of Dr. Sharp (U.S.A.); and reports were made by the German and French National Committees. Two very exhaustive papers were contributed by Mr. L. B. W. Jolley and Dr. J. W. T. Walsh on behalf of the British National Committees. These dealt with the problem both in theory and practice, and had special regard to the possibility of reducing glare. Dr. Bordoni, on behalf of the Italian Committee, similarly submitted a paper dealing with the problem of glare.

Further meetings of the Executive Committee of the Commission and of the Committee on Factory and School Lighting took place during the course of the afternoon. It was understood that the reports and papers, which were submitted to the various Committees with a view to final presentment at next year's plenary session, were not at present for publication.

Final Conference.

On Saturday morning, the delegates met in full conference under the presidency of Dr. Hyde. It was reported that the Sub-Committee appointed for the purpose had gone carefully into the question of work which should be proceeded with by the Commission, and had made an allocation of subjects to be investigated to the various constituent countries which would undertake the secretarial work in connection with same

Dr. Hyde expressed his great appreciation of the support the members had given him, and stated that Mr. C. C. Paterson (London) had been elected by the Executive Committee as President of the Commission. He spoke eulogistically of Mr. Paterson's qualities. The remarks were greeted with enthusiasm, indicating that the election was a popular one.

M. Filliol (Geneva) was appointed to the post of Treasurer, previously occupied by the new President. Both gentlemen expressed their thanks. Mr. Paterson suggested and proposed the election of Dr. Hyde as a permanent member of the Commission, in view of the helpful work he had done before and during his presidency; and this was unanimously agreed to.

The meeting then proceeded with the consideration of four papers which had been submitted. These were as follows: "The Teaching of the Science and Art of Lighting," by Sig. C. Clerici; "The Activity of the Osram Company in Europe, in perfecting Lighting," by Sig. S. Danesi; "The Illumination and Apparent Illumination of Roadways," by Sig. G. Peri; and the "Black Body Standard of Light," previously presented by M. Janet. These papers were not read, but simply introduced in short statements by the authors. Only one paper had been previously circulated, and the others were fresh to the delegates. Copies were not available, and discussion was therefore not merely difficult, but practically impossible in the circumstances. The first-named paper did invite, and obtained, comments; but the speakers were limited in number in consequence of time. It was understood that the papers will ultimately be published, and may be included with a brief official account of the meetings which is shortly to be published.

A renewed invitation to the Commission was extended by Dr. Sharp, on behalf of the American National Committee, for the plenary session to be held in the United States; and this was cordially accepted. It was decided to arrange for the Conference to take place in September, 1928.

The excellent services of Dr. Walsh as General Secretary to the Commission were warmly acknowledged by M. Janet, on behalf of the delegates; and his speech was greeted with acclamation.

M. Filliol expressed to the Italian Committee the cordial thanks of the members for the kind welcome and hospitality received; and Prof. Bordoni replied in acknowledgment.

Restricted Use of Gas for Illumination in Italy.

At the close of the meeting reference was again made by the Italian delegates to the restricted use of gas for lighting in their country. Heating by both gas and electricity was becoming more important, and probably in a short time a similar institution to that of the Commission might be required to study heating subjects. The speaker suggested the possible limitation of gas lighting interests in other countries as in Italy, and asked if the Commission were going to lose their gas members. If heating matters were included in their general programme, there would be a definite linking-up of the two industries, especially as electricity was also interested in the subject. It was stated that the Italian National Committee proposed to bring the question up at the next plenary session of the Commission.

The Italian members made the visit of the delegates to Bellagio thoroughly enjoyable, and included in their arrangements a garden party at the Villa Serbelloni, and a dinner at the Grande Bretagne Hotel. There was an excursion at the end of the week to the Villa Clerici, at the invitation of Sig. Clerici.

The delegates in some return entertained the Italian members and their ladies to dinner on the Friday evening at the Hotel Splendide.

At the whole of the meetings, as at the various social functions, the members fraternized freely; and a general spirit of friendship and extreme cordiality prevailed.

"FOSALSIL" INSULATING MATERIAL.

Opening of New Works at Colchester.

The interest in insulating materials was strikingly manifested at the opening, by Moler Products, Ltd., of up-to-date new works at Hythe, Colchester, on Sept. 8. The capacity of the new works will quintuple the output of "Fosalsil" (Moler) insulating bricks, partition blocks and slabs, and cement, thereby assisting greatly to meet the ever-increasing demand for a product which is fire, heat, cold, and sound proof.

The new works are situated on a 30-acre site between the tidal river Colne and the L. & N.E. Railway. A huge double gantry unloads the earth from the vessels and serves a belt conveyor which feeds two 45-ton hoppers, whence the material passes to the water mixing plant.

The sole selling agents for "Fosalsil" (Moler) insulating bricks, &c., are Messrs. J. H. Sankey & Son, Ltd., of Essex Wharf, Canning Town, E. 16. "Fosalsil" products can be seen, and information obtained, at the City Offices of Messrs. Sankey, at 7-8, Norfolk Street, Strand, W.C. 2. An informative illustrated brochure dealing fully with the subject of "Fosalsil" and its nature and uses may be obtained from the firm on request.

A NEW FINISH FOR GAS GRATES.

It is pleasing to learn that, with the great developments which have taken place in the efficiency of gas grates, makers have not overlooked the important matter of producing them in ways which enable them to harmonize with the many styles and periods of decoration.

In their new series of "Classic" gas grates in wrought-metal finish, Messrs. John Wright & Co. have enlisted the services of the artist and the craftsman to produce a grate so distinctive as to satisfy the most exacting critic—each grate has its own individuality in colour, finish, and marking.

The endeavour has been made to recapture the beauty of the handicraft work of generations ago, with the result that these wrought-metal grates have that indefinable "character" which distinguishes the hand-made from the machine-made article.

Wright's "Vandyke" and "Inigo" grates have perhaps established a position in gas heating that hitherto has never been approached; and now that these grates can be obtained in the hand-made wrought-metal finish—which compares with the work of craftsmen of bygone days—their value will be more than ever appreciated.

The choice of wrought copper, brass, or pewter finishes adds greatly to the charm of the "Classic" design, and gives what may be termed a personality to each individual grate. The grates in these new finishes, like all of Wright's series of "Classic" gas grates, incorporate the "Thermo-XX" radiants and patent "Injector-Ventilator," which have done so much to popularize domestic gas heating.

"B.C.G.A." Meeting at Southampton.

Those who intend being present at the meeting, and have not communicated with the Secretary, should do so promptly.

Eastern Counties Gas Managers' Association.

The half-yearly meeting of the Association will be held at Cambridge on Friday, Sept. 30. Members will meet at the gas-works at 11.30. Following the inspection of the works, members will be entertained at luncheon, at the University Arms Hotel, on the invitation of the Chairman and Directors of the Cambridge University and Town Gas Light Company. The business meeting will be held in the Council Chamber of the Guild Hall at 3 o'clock, when Mr. Frank Prentice, of Ipswich, the President, will take the chair. Mr. J. W. Auchterlonie, the Engineer and Manager of the Company, will read a paper on "Some Alterations at the Cambridge Gas-Works between the visits of the Eastern Counties Gas Managers' Association, 1910 and 1927." Another paper to be submitted will be by Mr. W. Carmichael Peebles, "Notes on Governors, and a Self-Loading Station Governor." Members will dine together at the Lion Hotel. The President will take the chair at 7.30.

INSTITUTION OF PUBLIC LIGHTING ENGINEERS.

FOURTH ANNUAL CONFERENCE AND EXHIBITION AT BRIGHTON.

Growing rapidly in the matter of its membership roll, and making equally striking progress in the ranks of specialized organizations, by reason of the importance of its work, is the Institution of Public Lighting Engineers, whose fourth annual conference and exhibition of lighting appliances took place on Monday, Tuesday, and Wednesday, Sept. 12, 13, and 14, at Brighton, under the Presidency of Mr. ALEX. C. CRAMB, M.I.E.E., M.I Mech.E., Electrical Engineer to the County Borough of Croydon. The proceedings began on the Monday evening with a civic reception and the opening of the appliance exhibition, reference to which is made at the end of this report.

The business of the conference was transacted in the Music Room of the Royal Pavilion; and in every way possible during the stay of the members, Brighton maintained that high standard of hospitality for which she has so long been famous.

Mr. R. DAVISON (Public Lighting Superintendent, Newcastle-upon-Tyne), the retiring President, occupied the chair on the opening morning, and as soon as the members had assembled introduced to them the Deputy Mayor of Brighton (Councillor J. Lord Thompson).

A WELCOME.

The DEPUTY MAYOR explained that the reason why he appeared before them was that the Mayor of Brighton (Councillor Richard Major) was absent from the town fulfilling another engagement in the West of England, which engagement had been fixed a considerable time ago. Therefore he (the speaker) had been requested, as the Mayor's deputy, to extend to the members a cordial welcome to Brighton. This it was a great pleasure to him to do. It was the policy of the Town Council of Brighton to encourage bodies to hold their conferences there, by placing at their disposal these wonderful buildings in which to discuss their business. If, therefore, in a year or two the Institution should think that a further conference should take place in Brighton, he hoped the officials would not be backward in suggesting it, because the Town Council would again do everything in their power to ensure the success of the meeting. The subject with which the Institution had been formed to deal was a most important one. By turning darkness into light, they were performing a service to the whole community, because it was by light that the condition of the people would be improved both in mind and in body. The Brighton Corporation had recently obtained an Act increasing the boundaries of the town; and there was no doubt that between the Gas Company (which was a private concern) and the Brighton Electricity Undertaking (which belonged to the town) there would be a great deal of friendly rivalry; but, at the same time, there would be ample work for a long while for the Engineers of both, in supplying the needs of these districts.

Mr. DAVISON, in thanking the Deputy Mayor for his kindly welcome, and the interest he had shown in the proceedings of the Institution, said the members were concerned with a highly important public service; and in order that they might carry out their work efficiently, they must have the civic chiefs with them.

MEMBERSHIP.

The minutes of the last meeting having been confirmed,

The HON. SECRETARY (Mr. W. J. Liberty) announced that over 20 further members had been enrolled since the last meeting. The total membership of the Institution was now 138.

ARTICLES OF ASSOCIATION.

Mr. H. C. Brown and Mr. A. J. Kenward having been appointed Scrutineers of the ballot papers,

Mr. T. WILKIE (Leicester) moved a resolution to the effect that the Articles of Association and the by-laws be referred back to the Council for further consideration.

Mr. S. B. LANGLANDS (Glasgow), seconding, remarked that their best thanks were due to Mr. Wilkie for the good work he had done. He had undertaken an enormous task, and had accomplished it well.

Mr. DAVISON said the resolution (which was at once agreed to) would give the Council power to get the Articles finished.

It was intimated that, in compliance with the wishes of the Board of Trade, the word "Association" will be used in the title, in place of "Institution."

Mr. DAVISON then called upon the new President, Mr. ALEX. C. CRAMB, of Croydon, to take the chair.

Mr. CRAMB, after acknowledging the honour that had been conferred upon him, proceeded to deliver his address.

PRESIDENTIAL ADDRESS

Of Mr. ALEX. C. CRAMB, M.I.E.E., M.I.Mech.E.

There can be little question in my opinion that there is much useful work which may be done by an institution formed for the purpose of accomplishing the objects which this Institution has in view. We have been told, on the authority of your past President, Mr. Davison, and also by other persons equally qualified to express an opinion on the matter, that there has been very little improvement in the standard of street lighting since 1914. When one considers the great progress that has been made in other directions in the last ten or twelve years, this fully justifies the formation of the Institution; and it only remains for the members to see that the present unsatisfactory state of affairs is changed with the minimum of delay.

There seems to be two schools of thought in regard to street lighting. There are those who consider expenditure on street lighting more or less a waste of money, and therefore only agree grudgingly to the expenditure of the minimum amount for such a purpose. On the other hand, it cannot be denied that there are some enthusiasts who do not pay due regard to the economic aspect of the question. There is no doubt that the proper course lies in the happy medium between the two extremes.

The rapid increase in mechanically propelled fast traffic has changed the whole aspect of road transport; and the necessity of dealing with the new position has been appreciated by the Government, who now spend large sums of money in the construction and improvement of roads. Unfortunately, the Ministry of Transport do not seem to realize that the money which is provided comes out of the pockets of the motor owners; and to them, as well as to the public generally, illumination is equally important as the construction of the roads. It should be one of the duties of the Institution to see that the Ministry are kept fully cognizant with this aspect of the question.

STANDARD SPECIFICATION FOR STREET LIGHTING.

There are several bodies already in existence formed for the purpose of dealing with the question of illumination; the International Commission on Illumination co-ordinating the work of the National Committees of the various countries for the mutual benefit of all. The National Illumination Committees of the individual countries can do much good for their own countries, and the work of the National Illumination Committee at home, in conjunction with the British Engineering Standards Association, has resulted in a very useful document—a suggested "B.E.S.A." Standard Specification for Street Lighting, which is the most important matter that comes under the notice of this Institution at their annual meeting on this occasion. The establishment of this standard specification should prove a milestone in the development of thoroughfare illumination, and be invaluable in tending to improve the standard of illumination.

It is claimed for this specification that it will improve the standard of public, or street, illumination. In my opinion, this improvement is much to be applauded; but I feel that there has been rather a tendency to emphasize a standard of illumination much in excess of the existing best-lighted thoroughfares in the country. The lighting of thoroughfares such as Whitehall and Oxford Street, which in the specification are appreciably down the scale, seems to me to be ample for all practical purposes in these thoroughfares. What I consider is of real importance is to improve the lighting of the enormous mileage of less important thoroughfares throughout the country.

Inspection of the illumination of the various towns may show possibly one or two short stretches of thoroughfare the illumination of which is satisfactory for practical purposes; but, on the other hand, there are many miles of streets in any such towns where the illumination is of extremely low standard. These require immediate attention; and I feel that much greater benefit will arise from trying to improve the standard of illumination at the lower end of the scale than by worrying about improving the standard of illumination of a few of the already well-lighted streets.

I believe it has been decided to add a further standard class to the specification; and I consider this essential. In each area it seems important in the first place to grade the different thoroughfares into classes for illumination purposes, in the same way as roads are graded by the Ministry from the point of view of their importance for traffic conditions; but the number of grades will require to be greater. For each of these grades there should be a range of illumination in which the maximum of illumination should be considered for such a grade of thoroughfare together with the minimum illumination; and nothing below this should be tolerated in any circumstances. It is frequently pointed out, and should be emphasized in connection with the grading of illumination for the different thoroughfares, that it is important there should be no sudden change in the degree of illumination on entering from one thoroughfare to another, but that the illumination should be graded so as to avoid accidents from such sudden change.

FITTINGS NEED CONSIDERATION.

It appears to me that there is a great deal of work to be done by the Institution in connection with the evolution of the

most efficient type of fitting for various classes of thoroughfares. A fear has been expressed in certain quarters that the specification may tend to get such an even illumination that obstacles in the road cannot be easily seen by the drivers of vehicles. I think, however, there is little fear of this occurring under actual conditions. On the other hand, owing to the obsolete construction and design of most street lighting fittings, and to the varied distance apart of the standards from which the fittings are suspended, driving is frequently difficult in towns because of the rapid change in the degree of illumination along the road surface.

In the case of some important thoroughfares where the amount of money and energy expended in illumination is considerable, the height from the ground can be made sufficient with suitably designed fittings for distributing the light along the road, and an illumination which to the eye is uniform enough to give satisfactory driving facilities can be obtained; but where the degree of illumination is reduced from economic considerations, and the points of suspension are a considerable distance apart, the problem is a much more difficult one. It is frequently pointed out that street lighting is the "Cinderella" of all the public services, and that money is voted more grudgingly for this purpose than any other.

Meeting the Cost.

As I visualize the position, it would seem that the cost of illumination of all thoroughfares in which there is any considerable road traffic should be contributed from two sources. There is the expenditure which the local authority should properly provide for the reasonable illumination of their thoroughfares in order to ensure public safety; and this should be supplemented by a proportion of the funds subscribed by the motor owners through taxation, to meet the extra expenditure necessitated by motor traffic conditions. There is no doubt that fast-moving traffic demands a very much higher standard of illumination. On the other hand, it is most certainly contended that the owners of such vehicles contribute sufficient in the form of motor taxation to pay not only the increased cost of construction and maintenance of roads, but also that which is necessary to supplement the standard of illumination to meet the requirements of modern traffic conditions. Strong protests have been made against the so-called grabbing of the road fund for expenditure which has nothing whatever to do with road traffic; and the present deplorable state of the lighting of the majority of thoroughfares in the country, as well as the large amount of work of road maintenance, is presumably a result of the appropriation of portions of this fund in directions which the public never anticipated when this taxation was originally instituted.

Probably, if the taxation paid by motor owners is properly to be considered as revenue to provide for the construction and maintenance of the thoroughfares in the country under efficient conditions both by day and night, it would appear advisable that this work should be severed from the political control of the Government, so that the large amount of necessary expenditure could be properly met from the income derived for that purpose. If a portion of this taxation received from private cars is to be considered as a luxury tax which is to be paid into the general revenue of the country for such purposes as the Government at the time may decide, then it would appear that considerable increased taxation should be made on the heavier vehicles which are so destructive on road surfaces. The essential fact of the case is, however, that there is money available which has been paid by the taxpayers of the country for a specific object, but that this money has been diverted to channels other than those for which it was intended, with the result that there is considerable increased danger to the public through inefficient illumination, as well as from unsatisfactory thoroughfares.

Proper Control.

The modern tendency throughout the country is to put the control of many public services under one central board of experts; and the extension of this policy would certainly seem to tend in the direction of efficiency and economy. Such a course has already been adopted in regard to electricity; and there is little doubt that other services, such as water, will sooner or later have to be dealt with in the same way. Illumination of thoroughfares seems so essential a matter that it should come under proper centralized expert control. The artificial boundaries of local authorities tend to a great variation in the standard of illumination along a stretch of thoroughfare which is not only dangerous to the public, but extremely irritating. It seems an elementary principle that there should be standardization of not only the degree, but the efficiency, of illumination in thoroughfares, and that this should not be subject, as at present, to the violent interruptions that mark the boundaries of neighbouring local authorities. The variation in illumination is not confined to sections of streets in the areas of different authorities, but is to be found even in the area of an individual authority—probably owing to lack of co-ordination in the different departments.

Planting of Trees.

The planting of trees in thoroughfares, it is generally agreed, tends to improve the appearance of a district; but many of the authorities seem to be of the opinion that the best effect is to be obtained by planting a number of trees out of all proportion to the space available. It is quite certain that trees planted close together along a road render any form of street lighting, except central suspension, thoroughly inefficient; and even in the case of central suspension lighting the efficiency is considerably reduced. It is a simple fact, which should be evident to anybody, that it is waste of money to attempt to light streets unless due regard is given to the spacing of the lamps and the placing of trees in their proper positions. It seems obvious that the order of dealing with this matter is, in the first place, to decide on the scheme of illumination, and to erect the necessary street lighting units, and afterwards to group the trees in such a way that they have no serious effect on the distribution of light.

Reflecting Devices.

I believe that, generally speaking, the improvements which have taken place in illumination of thoroughfares have been due to the enthusiasm of a few men in different districts rather than to concentrated attention or keenness on the part of public bodies. The Institution might aim at a higher standard of design in supports and fittings for public lighting units, as the present infinite variety, mostly of unsatisfactory appearance, does little credit to those engaged in this work. The most important object of the street lighting engineer, however, should be the question of efficiency—that is to say, the utilization of the luminous energy available to obtain the maximum lighting effect on the thoroughfare.

That this can be accomplished to a large extent by the use of suitable modern reflecting or refracting devices is proved by the following figures, which have been obtained by tests taken under actual service conditions in the various classes of Croydon thoroughfares. In the main road the expenditure of 300 watts per standard gives an intensity of 300 c.p. directly below the light source; and, by means of plain mirror reflectors, the available candle-power at the mid-span point is increased to over 2000. With 200-watt fittings the corresponding figures are 200 and 1300 c.p. respectively; while in the side streets single 75-watt lamps give an available 540 c.p. for mid-span illumination.

The use of these or similar devices tends to level-up the degree of illumination, thereby reducing the ratio of maximum to minimum; and at the same time a much higher average illumination is obtainable for a given expenditure of energy. To illustrate this point I may quote tests taken in one of the principal Croydon thoroughfares, where, with 450-watt fittings spaced 110 ft. apart, the maximum illumination is 0·87 foot-candle and the minimum as high as 0·28 foot-candle.

While I am aware that these results do not represent the maximum that can be obtained from directional reflecting devices, I think they will serve their purpose in showing what may be done by proper attention to the selection of suitable light distributing agents; and I would point out that the results have been obtained without in any way detracting from the appearance of the light source. On the contrary, the effect of the mirrors is to produce the illusion of a greater number of lamps per standard than actually exist—an important point.

Conclusion.

The lighting of the thoroughfares is in the main put in the hands of the surveyors of local authorities. These men have had increasing responsibility thrown on their shoulders, and they are expected to be experts in far too many directions; so that it is inevitable, with the small amount of time they can devote to this particular branch, that no great advance can be anticipated. The managers of gas and electrical undertakings, who are often responsible for this work, have also so many calls on their time that it is impossible for them to give that concentrated attention which is essential for the necessary advancement. Therefore some of the principal towns in the country, having recognized the growing importance of efficient illumination of their thoroughfares, have appointed men specially qualified for this work; and it is these men, who can devote their whole time to the economy and efficiency of their systems, who must be looked to for the much-needed advance.

There is another direction in which the Institution may do much valuable work and assist the Ministry of Transport, and that is in the design and regulation of the various illumination signs for traffic control. It is to be hoped that, by tackling this problem in the early stages, and by giving careful consideration to the most effective and efficient designs, with full regard to artistic appearance, the thoroughfares of this country will not be further disfigured.

The Question of Improvement in Street Lighting.

Mr. C. S. Shapley (Leeds), proposing a hearty vote of thanks to the President for his address, remarked that Mr. Cramb had, as he expected would be the case, been very bold; and were it not a Presidential Address, there were many items one would feel inclined to discuss. But therein lay the excellence of the address. There was just one matter he was going to ask permission to refer to—where the President said they had been told "that there had been very little improvement in the standard of street lighting since 1914." He must point out in self-

defence that year after year they prepared in Leeds a report upon their street lighting; and these reports revealed an enormous increase in the efficiency of the lighting since 1914. Mr. Langlands' reports, the latest of which he had just seen, also showed like progress. He would not like any members to go away with the idea that in such "obscure cities" as Leeds and Glasgow there had not been any improvement in street lighting since the outbreak of war. There must be many in the room who would agree with him when he said that since the inception of that Institution there had been a considerable improvement in street lighting generally. No doubt there was room for much further improvement; but in going up and down the country he found evidence of greater attention being given to cleaning and to increasing in other ways the efficiency of existing appliances. They were greatly indebted to the President for the good material contained in the address. [Applause.]

The PRESIDENT said he thought he would not be far wrong in saying that in a few instances considerable improvement would be found, but that in the bulk of the cases there had been very little improvement. There were, of course, some notable exceptions, like Glasgow and Leeds; but taking the country up and down—villages and large and small towns—there had not been that general advance which there ought to have been. ["Hear, hear."] This was really the point he was trying to bring home.

THANKS TO THE PAST PRESIDENT.

Mr. HAROLD DAVIES (Chesterfield) proposed a cordial vote of thanks to Mr. Davison for the manner in which he had filled the office of President during the past year. He had done this, not only with credit to himself, but with advantage to the Institution.

Councillor T. ADAM (Chairman of the Lighting Committee, Edinburgh), having been present at last year's conference in Newcastle, said he felt particular pleasure in seconding the motion. On that occasion Mr. Davison carried out the duties of President with admirable precision and efficiency.

The PRESIDENT supported the vote, which was passed by acclamation, and acknowledged by Mr. DAVISON.

STREET LIGHTING SPECIFICATION.

Mr. L. B. W. JOLLEY then presented a paper entitled "Discussion on the British Engineering Standards Association Draft Specification for Street, Lighting." This, with a report of the long debate which ensued upon it, will be found elsewhere in the present issue.

GOOD WISHES FROM THE "B.C.G.A."

During the proceedings, a telegram was received from Mr. F. W. Goodenough, C.B.E. (Executive Chairman of the British Commercial Gas Association), wishing the conference every success, and expressing regret that it was impossible for him to be present.

AS GUESTS OF THE GAS COMPANY.

The morning session concluded, the members, with many other visitors, adjourned to the Banqueting Room of the Royal Pavilion, where they were the guests at luncheon of the Chairman and Directors of the Brighton and Hove General Gas Company. They were received by the Chairman (Mr. A. M. Paddon), who was supported by Mr. Joseph Cash (Director) and Mr. C. H. Rutter (Engineer and Manager). Mr. PADDON was in the chair. Mr. P. E. Browne (Distributing Engineer) was responsible for all the table arrangements; and he had as stewards Messrs. W. S. Bundy, J. A. Leak, A. E. Madle, R. C. Plunkett, and A. A. Yeomanson. So large was the attendance that additional tables were provided in an adjoining room; and these were presided over by Mr. Cash, Mr. C. H. Sandeman (Rental Superintendent), and Mr. H. Anscombe (Residuals Manager).

"OUR CIVIC AUTHORITIES."

The CHAIRMAN, having submitted "The King," proposed the toast of "Our Civic Authorities." He said he desired in the first place to tell the guests how gratified he and his colleagues were to welcome them, and how sincerely they hoped that their visit to Brighton might prove as pleasurable as interesting. He did not suppose that thirty years ago such a gathering as this would have been practicable. At that time the different elements constituting the present gathering were at something like sharp antagonism with each other. He was old enough to remember when the first livid pulsations of the arc light on the industrial horizon so frightened gas investors that many of them went along and sold their shares to others with wider vision who bought them. That was a time when competition was an industrial slogan; and it was held, with no particular intelligence, that one could not have too much of it. That was the idea of Parliament.

DISABILITIES AND DANGERS OF COMPETITION.

But, with the progress of events, it was borne in upon those responsible for public undertakings that one could have too much of a bad thing, just as one could of a good one; and that competition, whatever benefits it might have brought with it, had also very serious disabilities and dangers. It was found that, by the multiplication of overhead charges, it was a menace to economy; and it was found that under its stress bad work was apt to take the place of good. Well, these times had very largely passed; and to-day, he thought, most of those present realized that each could do his particular work and prosecute his particular enterprise without damaging the others, and without injuring the public. ["Hear, hear."] They had come to see that that which was antagonistic in the old days might now usefully be a co-operative element, and a complement to the other, and it was on these lines that they thought they might hope to progress, to their mutual benefit. In proof of this, two things had come to his notice recently. One of these was the Board of Trade Returns for 1926. If they examined these returns, as probably they would, they would find that where the supply of electricity and gas was under one common control both had developed to a very marked degree. ["Hear, hear."] This simply showed that they were getting a clearer perspective of what these particular enterprises meant to the public. The municipalities were economic umpires in the use of these respective commodities. Nothing had appealed to him more in Paris and London than the illumination of these two great capitals; and one could assume them to be classic instances of how the thing should be done. It would be found that both elements were used with judgment and discretion in promoting one great, admirable, and general effect. So he thought there was room for both of them in the future.

THE CHARYBDIS OF CENTRALIZATION.

Now they knew that, in avoiding the Scylla of competition, those in authority had nearly come to grief on its antithesis, the Charybdis of centralization. It was only a few years ago that he was personally engaged in examining certain projects for the concentration of the electricity supply of London; and he was immensely impressed, by the evidence adduced, and by the evidence extracted in cross-examination, with the many and great doubts obtaining in the minds of the experts as to whether this counter movement of concentration and centralization was not going too far, and bringing in its trail certain disabilities of its own. Because, just as competition warred against efficiency and economy—the very efficiency and economy that it affected to promote—so when one came to this centralization of industry at its source, there was a tendency to sterilize individual and particular excellence and aspiration, and to reduce the general average of results to something like mediocrity. This was the danger.

"LET THERE BE LIGHT."

Now, they might ask, with these two great dangers menacing those in public authority, who was to decide. This brought him to the subject of his toast, for the answer was "Our Civic Authorities." By the nature of their office and of their duty, they were peculiarly well placed to hold the balance even between the claims of processes or methods by which the public was to be served; and where they controlled these processes and methods, they might be trusted, as a matter of duty and interest, to apply them impartially, and justly, and equitably to the public use. This aspect of the case must appeal to those present who rendered the public the signal service that they did in regard to lighting. The first great generic postulate formulated in ordered life was: "Let there be light;" and though many ages had passed since then, he was sure no one of them would fail to agree with him that this great injunction and duty had not yet been exhaustively discharged. ["Hear, hear."] The cry would be for more light; and if this demand was met as it had been met in the immediate past by those to whom the duty had been committed to meet it, then he was perfectly sure they need have no fear for the future.

FRIENDLY RIVALRY.

The DEPUTY MAYOR OF BRIGHTON, responding in the absence from the town of the Mayor, said they had listened to a fine oration; and he congratulated Mr. Paddon upon the way in which he had submitted the toast. They were indebted to the Brighton and Hove General Gas Company for very generous hospitality, which he desired to acknowledge. After that, he desired to place on record the fact that, while gas was supplied to Brighton by a private Company, and the electricity undertaking was managed by the town itself, they never heard of anything but friendly rivalry between these two services. ["Hear, hear."] They knew Mr. Rutter, and they knew the other officials of the Gas Company; and he (the speaker), as a consumer of gas as well as of electricity, could say that he had never made a complaint which had not been immediately attended to. They did everything they possibly could for those who used gas in the town. On the other hand, they had Mr. John Christie, who had grown up with the electricity undertaking of Brighton, and had been a good and faithful servant of the town. No man had his heart more in his work than Mr. Christie; and he hoped that he would long continue to be the Borough Electrical Engineer.

SERVICE TO OTHERS.

The MAYOR OF BOURNEMOUTH (Alderman H. J. Thwaites), who was the next to respond, complimented the authorities of Brighton on having well-lighted streets. He took it the aim of every civic authority was to ensure, in its own area, progress on the right lines, and to induce the inhabitants to take a greater interest in the affairs of their governing body. The great curse to-day of municipal work was apathy among the electors, and the fallacy entertained by many residents that the progress of their town had nothing to do with them. It was necessary to get together and foster a spirit of good fellowship and the exchange of ideas. It was the duty of each one of them, as far as possible, to eliminate self and to practise service to others.

IN FAVOUR OF COMPETITION.

Councillor ANTHONY OATES (ex-Lord Mayor of Newcastle-upon-Tyne) also responded, and said he did not see why Mr. Paddon should apologize for competition. He himself felt that the nation had been built-up upon competition; and what they would do to-day without it, he did not know. It was the life of the nation, and one of the greatest things they had had to help them. During the past six years, Newcastle had been passing through a very serious period; but they were still optimistic enough to believe that the

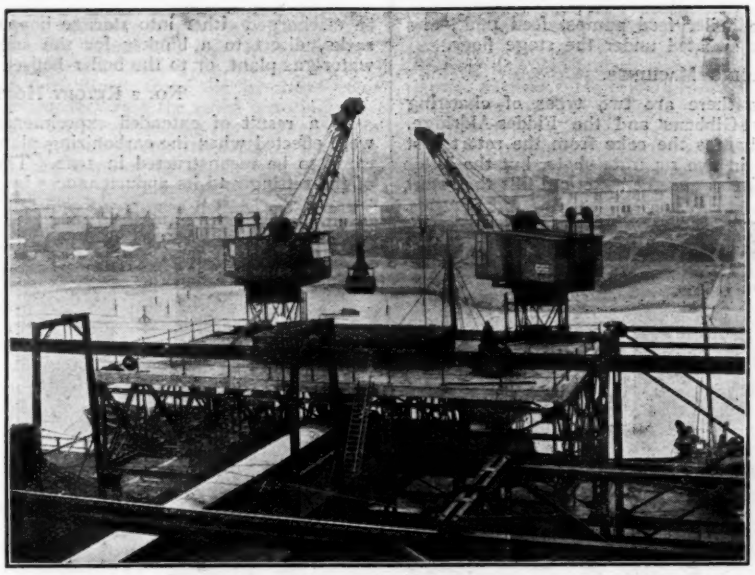

FIG. 1.—COAL DISCHARGING GANTRY, SHOWING THREE-TON ELECTRIC CRANES AND RECEIVING HOPPER.

time was not far distant when the district would again be busy as a coal port and a shipbuilding town. He knew many of those present were delighted with Newcastle when they were there for their conference last year. ["Hear, hear."] They would welcome the Institution back to Newcastle, when the time came—and he hoped it would not be too far distant.

"THE INSTITUTION."

The MAYOR OF CROYDON (Councillor A. J. Camden Field) proposed the toast of "The Institution of Public Lighting Engineers," coupling with it the name of the President. It delighted him to know that they had elected to the chair so good a man as Mr. Cramb, for whom in Croydon everyone had the greatest possible regard. By the united efforts of the members of the Institution, it was evident the public would obtain what was best in connection with a highly important service. Croydon could claim some association with the Chairman of this most pleasant gathering, because of the connection with the gas companies of both boroughs of the well-known name of Cash. Mr. Cramb's public service in Croydon dated back something like twenty-five years; and during that period, under his guidance, the Corporation Electricity Department had continued to progress. The generating station had been practically reconstructed; and to-day the coal consumed in producing a unit of electricity was two-fifths of what it used to be under the old system. They had in their President a man who would render excellent service to the cause which he and they had at heart—greater service in public utility, and greater utility in public service.

Mr. A. C. CRAMB (the President) expressed his thanks to the Mayor of Croydon for the terms in which he had submitted the toast. There was on the list no toast to the Chairman and Directors of the Brighton and Hove General Gas Company; but, as representing the Institution, it was his privilege and his great pleasure to thank the Chairman and Directors, on behalf of the members, for the splendid entertainment they had given them. [Applause.] Last year at Newcastle they experienced equal kindness at the hands of the Gas Company there. An Institution like theirs brought into touch two bodies of men who were in strong competition with each other. It used to be his practice to read in the weekly issues of the "GAS JOURNAL" the "Electricity Supply Memoranda;" and after having done so, he was in a very subdued mood. Perhaps because he had not had time to read these articles of late years, that feeling had worn off. But he had in the last few years been brought in contact with many gas engineers, and had been confirmed in the opinion he had long held (as the result of his knowledge of the officials of the Croydon Gas Company) that they were a very fine body of men. He considered it one of the special privileges of being a member of this Institution to have met, and become the personal friend of, many of those connected with the development of the gas industry. True, they were in competition; but there were various kinds of competition, and at any rate so far as the engineers were concerned they would never forget the engineering aspect. Up and down the country engineers of gas and electricity undertakings would be found giving each other assistance. This was the right spirit, because it was improving the efficiency of both gas and electricity, and therefore bringing about the best results for the public.

AT THE PORTSLADE GAS-WORKS.

The afternoon of Tuesday was devoted to a visit to the Portslade Works of the Brighton Gas Company and the almost adjoining Corporation Electricity Power Station, Southwick. For this purpose motor-coaches provided by the Corporation Lighting Committee were in waiting at the conclusion of luncheon. The members saw much to interest them; and they would, had weather conditions permitted, have seen a good deal more. At the gas-works Mr. Rutter was present, together with Mr. Corfield (Assistant Engineer); while the members of the Technical Staff who acted as guides were Messrs. A. Adams, D. L. Brown, J. H. Carrington, G. le B. Diamond, A. Harmes, E. A. Harmes, A. V. Morley, L. V. Palmer, and J. Wakeford.

The Portslade Gas-Works—the development and reconstruction of which, it will be remembered, were described by Mr. Rutter in the paper which he presented at last year's meeting of the Institution of Gas Engineers (see "JOURNAL" for Sept. 29, 1926, p. 828)—have at present a maximum winter output of about 10 million c.ft. per day; but the reconstruction recently undertaken, and now in hand, will raise the potential output to between 13 or 14 million c.ft. per day, making due allowance for plant acting as standby or under repair.

COAL HANDLING AND STORAGE.

The whole of the coal supply is received by sea from Tyne ports in steamers carrying from 600 to 850 tons. These are discharged at the wharf, which is equipped with two 3-ton electric grabbing cranes (by Stothert & Pitt) which discharge the steamers by grabs at the rate of 90 tons per hour, depositing the coal in a 60-ton hopper on the end of the gantry (see fig. 1). From this hopper the coal is fed on to a rubber and canvas belt conveyor of 90 tons per hour capacity. (It is interesting to note the excellent condition of this belt to-day, considering that it has passed over 750,000 tons of coal to the breakers since it was installed seven years ago.) The coal, after passing over a Blake-Dennison weigher, is conveyed along the gantry to two 45-ton per hour coal crushers situated between Nos. 1 and 2 retort houses. From the latter machines the coal is elevated in two bucket elevators to the extreme tops of the retort houses, delivering on to belt conveyors of similar capacity to the one already described, running the whole length of the houses—the coal being delivered to either house as required.

The coal bunkers in both houses are of reinforced concrete, and have an aggregate capacity of 1500 tons. The conveyors are provided with traversing throw-off carriages for discharging the coal into any of the overhead bunkers. An extension of the first conveyor on the gantry carries the coal to the stores, which are placed at the rear of the retort houses. The cost of discharging the steamboats in the manner described is between 5d. and 6d. per ton delivered into the overhead bunkers.

Conveyors between the coal stores and retort houses act as emergency coal handling plants in case of breakdown to the elevators.

NO. 1 RETORT HOUSE.

The carbonizing plant in No. 1 retort house consists of two blocks each of ten settings, each setting containing ten 24 in. by 16 in. Ω retorts 23 ft. long in five tiers. The retorts are of moulded fireclay, and are worked with a combustion chamber temperature of about 1300° to 1350° C., which is sufficient to burn-off a charge of approximately 10·38 cwt. in 8 hours. The total capacity of this house with all retorts under fire is 4 million c.ft. per day. The stage floor and overhead coal bunkers—the latter having a capacity of 750 tons, or two days' supply—are constructed of reinforced concrete on the Indented Bar Company's system.

At the eastern end of the house, two Spencer-Bonecourt waste-heat boilers are installed for the purpose of utilizing waste-heat from settings Nos. 1 to 10. One boiler is capable of producing enough steam to run the exhausters and tar and liquor pumps in No. 1 section; the average steam production being about 840 lbs. of steam from and at 212° Fahr. per ton

of coal carbonized. The boiler feed pumps, feed tank, and water softening plant are situated under the stage floor.

CHARGING MACHINES.

In No. 1 retort house there are two types of charging machines—viz., the Guest-Gibbons and the Fiddes-Aldridge. The former machine discharges the coke from the retort first and then puts in the coal in five separate shots, but the latter machine simultaneously discharges the coke and fills the retort with a fresh charge of coal; consequently it is considerably faster in action than the Guest-Gibbons machine.

A similar equipment of stoking machinery is provided for No. 2 house.

COKE DISCHARGE.

Coke handling out of the retort house is carried out by means of Drakes' transporters, which discharge through the window-ways of the house on to an outside quenching bench constructed in reinforced concrete and paved with blue-bricks. This method of coke handling has proved satisfactory, and has the advantage of disposing of the coke quickly out of the house, thus avoiding a considerable amount of smoke and steam. It has the further advantage of preventing the penetration of water or coke fumes into the basement floor; thus the process of clinkering the furnaces is effected in cleanliness and comfort (see fig. 2). The coke is removed from the quenching bench by means of skips, which travel on a telpher track running the whole length of the coke ground, and can be discharged either into storage hoppers for filling carts and sacks, direct to a bunker for the supply of the carburetted water-gas plant, or to the boiler house.

FIG. 2.—UNDER THE DISCHARGING FLOOR, SHOWING REINFORCED CONCRETE FLOOR SUPPORTS.

NO. 2 RETORT HOUSE.

As a result of extended experiments, many improvements were effected when the carbonizing plant in No. 2 retort house came to be reconstructed in 1922. The general arrangement of the setting and its appurtenances is of "Brighton" design, and embodies improvements dictated by past experience with other types—*e.g.*, extended producer mouthpiece to facilitate filling the furnaces, for which a special machine is provided; a reduction of the retort heating surface covered by the cross-walls (the total area of retort surface exposed to the heat is 53 p.ct.); a producer 13 ft. deep for the better maintenance of heats; and an improved regenerator.

The western section was completed first, and has been at work for nearly four years. The eastern section, however, was not undertaken till later; and while the ten settings are built, the retort-bench ironwork is not yet erected. The first-mentioned settings of retorts are of moulded fireclay; but the ten new settings have 95 p.ct. segmental silica retorts.

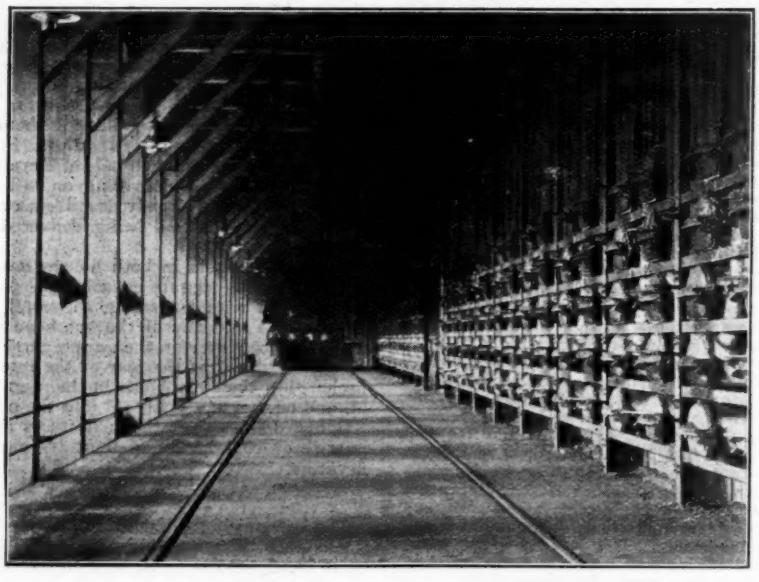

FIG. 3.—CHARGING FLOOR, SHOWING REINFORCED CONCRETE COAL-HOPPER SUPPORTS, &c.

The stage floor and overhead coal bunkers in this house are also constructed of reinforced concrete (see fig. 3).

THE CARBURETTED WATER GAS PLANT.

This consists of five Humphreys & Glasgow carburetted water gas sets; four of them being equal to 1½ million c.ft.

per day, and the fifth to 2 million c.ft. per day. The larger set is controlled by hydraulic valves and electrical automatic gear, which effects a considerable saving in labour. It also has an automatic coke feed direct from the overhead coke bunkers, the other sets being fed from the usual coke buggies. The coke is elevated to the conveyor feeding the overhead coke bunkers by means of a large Drakes' coke transporter fed from the reinforced concrete coke bunker, to which reference has already been made.

Two Humphreys & Glasgow waste-heat boilers are installed—one on No. 1 set and the other on No. 5 set—for the purpose of recovering the waste heat contained in the blow gases. The production of steam from these two boilers is approximately 60 lbs. per hour from and at 212° Fahr. per 1000 c.ft. of gas made, which is sufficient to render these two sets independent of an external steam supply. The necessary feed pumps and Permutit water softening plant for these boilers is housed in a small brick building adjacent to the retort house.

Turbo blowers are installed in the engine-room below the stage floor; and three blowers driven by reciprocating engines in No. 4 engine-house provide the blast for the smaller sets.

Coal Stores.

The coal stores lie at the rear of Nos. 1 and 2 retort houses, and are designed to hold, to rail level, approximately 13,000 tons. With trimming, however, a total of 18,000 to 20,000 tons can be stored, and a further 4500 tons can be stored on No. 1 coke yard. The stores are divided by cross-walls into compartments holding from 800 to 1200 tons, which enables any spontaneous combustion of the coal to be isolated. Tubes 3 in. in diameter are inserted to the full depth of the coal at regular points throughout the stores, and the temperature is taken in each tube at frequent intervals, so that any undue heating is immediately revealed. The practice is to remove at once the upper portion of the coal at that spot, and almost invariably the temperature is reduced to normal. Directly the temperature exceeds 100° Fahr., danger is anticipated, and action taken.

Supply Area.

The Company's statutory area is approximately 42 square miles in extent, although some parts are not sufficiently developed to warrant the gas mains being laid. It is bounded on the east by Telscombe, about 3 miles north-east of Rottingdean Village, and on the west by Lancing, about 1 mile east of Worthing. The extreme length of coast line is about 14 miles and the depth of area at present supplied about 3 miles. The consumers supplied number approximately 61,000; and the length of mains laid is 250 miles.

High-Pressure Gas Distribution.

A complete ring main of 12 in. diameter and 6½ miles long is laid round the outskirts of the town to unite the two holder stations of Hove and Black Rock, at each of which is installed a Reavell electrically-driven gas compressor, for increasing the pressures in the arterial mains in the outlying areas. Each compressor is capable of passing 150,000 c.ft. of gas per hour at an initial pressure of 5 lbs. per sq. in., though, at present, they are working at about 1½ lbs. per sq. in. and delivering about 70,000 c.ft. per hour, to be increased as occasion demands. Connections to the arterial mains are made at five selected points through Peebles underground governors, placed in pits under the public pavements, with cast-iron pillar-boxes above ground for housing the necessary recording instruments. For the electrical power required for the compressors, gas engine driven dynamos are installed at Hove and Black Rock.

Subsequent Proceedings.

Our report of the proceedings at the annual dinner of the Institution on Tuesday evening, and of the resumed business of the conference on the Wednesday morning, must be held over for the next issue of the "JOURNAL."

EXHIBITION OF LIGHTING APPLIANCES.

On the Monday evening preceding the business conference, an exhibition of gas and electric street lighting appliances was opened in the Corn Exchange, Pavilion Grounds, Brighton. It was a representative display; the gas exhibits being on one side of the hall, and those relating to electricity on the other. The opening ceremony was performed by the Deputy Mayor of Brighton (Councillor J. Lord Thompson), who was accompanied on the platform by the Deputy Mayoress and the Mayor of Bournemouth (Alderman Harry Thwaites) and the Mayoress, together with Councillor Anthony Oates (ex-Lord Mayor of Newcastle-upon-Tyne).

Councillor LORD THOMPSON apologized for the absence of the Mayor (Councillor Richard Major), who, he said, was absent from the town, and was missing his first conference of the year, greatly to his regret. In order to add to the value of the conference, the display they saw around them had been got together. He could not help thinking that gatherings of the kind the Institution were holding went a long way towards creating good feeling all round; and the addition of an exhibition to the other business was a splendid idea. The authorities would see many things which should assist in the good lighting of their towns, and at the same time save the ratepayers' pockets. He invited those present, after inspecting the exhibits, to partake of the lignt refreshments which the Mayor had provided for them.

Mr. C. S. SHAPLEY (Leeds) said their retiring President, Mr. Davison, had asked him, on behalf of the Council of the Institution, before formally thanking the Deputy Mayor for his presence, to propose a vote of thanks to the exhibitors for having co-operated with the Institution in putting up so excellent a show. The public lighting engineers greatly appreciated this co-operation of the manufacturers with their Institution. Much benefit was derived from exhibitions such as this; and their thanks were certainly due to the different firms who had taken the trouble to bring their specialities forward in this way.

Mr. PHILIP SUGG, on behalf of the exhibitors, acknowledged the vote of thanks that had been proposed by Mr. Shapley. The manufacturers represented, he declared, very much appreciated the opportunity which had been afforded them of coming along and showing what they could do in the best interests of the public. Good street lighting was now recognized as being of primary importance; and in this connection the exhibition should prove of value.

The RETIRING PRESIDENT (Mr. R. Davison, of Newcastle-upon-Tyne) then offered the sincere thanks of the Institution to the Deputy Mayor for having come to open the exhibition. Mayors and deputy mayors were important people; and they were just the sort of people the Institution were trying to attract to a recognition of the importance of public lighting. If they could not get such gentlemen to interest themselves in the work of the members of the Institution, they would never get much further with public lighting, because they were the men who could pull the strings and give them the necessary money. When they could command attention from such important places as Brighton, it was evident that they were progressing. The Institution was really just beginning to get on to its feet.

The Exhibits.

Altogether there were some two dozen stands, about one-half devoted to gas appliances and the other half to electric apparatus—all, of course, making special appeal to the public lighting engineer. Space will not permit of a lengthy notice here of the appliances displayed—with many of which "JOURNAL" readers naturally are already well acquainted—but the following brief notes will give a fair indication of the exhibition, so far as the gas portion of it was concerned.

British, Foreign, and Colonial Automatic Light Controlling Company, Ltd., Bournemouth.

There were some good displays of automatic lighting and extinguishing apparatus, the business in which is growing rapidly. At all times a desirable proposition, the automatic control of public lights has become even more so in view of the heavy increase in cost of manual labour during recent years. The latest forms of their well-known "Gunfire" controllers were shown by this Company. There is nothing "hard-and-fast" about these controllers. They can be had in forms to suit all kinds of requirements; and a desire for hand lighting on occasion need prove no bar to their adoption.

The latest "Gunfire" box controller for either suspension or parade lamps has a clockwork movement which is identical with that of the Type D, and can be removed and replaced without disturbing any gas connections. This box controller is only 5 in. over-all, and is guaranteed to pass 20 c.ft. per hour at 25-tenths inlet and 23-tenths outlet pressure. The aluminium case is provided with a screw-up lock actuated by the same key that winds the clock.

William Edgar & Son, Ltd., Blenheim Works, Hammersmith.

This firm make street lamps in large numbers and many varieties; and a good selection of patterns could be studied—including a large hexagonal "Waterloo" lantern. The "Eclipse" suspension lamp claimed attention as an efficient and serviceable looking article.

Falk, Stadelmann & Co., Ltd., Farringdon Road, E.C.

There were shown on this stand "Veritas" mantles to meet varying street lighting needs, together with a wide range of street lighting burners. The latest type of the "Ukay" inverted lamp embodies many improvements suggested by experience. There are detachable air and gas regulators, which can be readily removed for cleaning purposes. Other forms of outside lamps—each having some special feature of its own—were displayed by this firm, who have, of course, for many years past set themselves out to meet the requirements of public lighting engineers. Experiments are being made with an all-British ruby danger globe.

Foster & Pullen, Ltd., Bradford.

Further excellent lamps for street lighting were displayed on this stand. The firm's lamps are guaranteed to be stormproof. The "Avil" inverted lamp with "U" bracket is made with varying numbers of nozzles, and with brackets of

different styles. It has been designed to meet the requirements of a prominent superintendent of public lighting, and represents an endeavour to combine the advantages of the inverted lamp with the accessibility of the square lantern.

The upper portion, or canopy, of the casing of the "Avil" inverted lamp with "U" bracket is hinged, and may be opened in the usual way. The hinge, however, is constructed in such a manner that by a simple sliding movement the upper casing may be entirely removed, and just as easily replaced. When the casing is open the burner may be lifted out. There are no close-fitting parts likely to stick when the lamp has been in use for a time. Both the gas and air regulators are absolutely positive in action. There are no springs, sleeves, or other parts likely to become useless after a short period. The gas supply to burner and by-pass is controlled by a lever cock which, with the accessories, forms an interesting feature of the combination. The by-pass is regulated by a specially designed auxiliary plug on the cock, and the usual regulating screws are dispensed with, thus avoiding trouble from corroded and broken screws. Attached to the cock is an adjustable connection to the service pipe. This consists of a 6-in. length of tubing with a sliding stuffing box to suit varying heights of service pipe. This avoids the necessity of making special fittings for connecting each lamp, and reduces fitting time enormously.

Candle power charts were on view which revealed the efficiency of the lamps.

The Gas Meter Company, Ltd., Kingsland Road, London.

The Company made a special display of "The London" automatic controller for lighting and extinguishing public lamps. This well-known controller consists of a clock and gas tap mechanism, the latter comprising a separate train of wheels released in readiness for action a short time before the predetermined time by means of a two-armed lever actuated by pins connected to the moving dial. The clock is fitted with a special Swiss lever escapement, fully jewelled; and it is noted for its accuracy and reliability in timekeeping. A dust and insect proof brass case encloses the controller, the lid of which only needs to be removed for winding and setting. An outstanding feature of the controller is the simplicity with which it is set. There is no occasion to loosen screws, nuts, or other parts when altering the time for lighting and extinguishing, as it is only necessary to move the pointer to the required time, and it is held in position on the slotted dial. The regulation of the clock is a very simple matter; the regulator being in sight. Another outstanding feature of the controller is the practically frictionless patent gas tap, which is operated by a second train of wheels independent of the clock mechanism. This is constructed so that the pilot light is automatically turned off when the burner is lighted up. The controller is readily adapted for use with cluster burners, one or more of which can be extinguished at midnight or any other desired time.

Horstmann Gear Company, Ltd., Bath.

There was more evidence here of the deserved popularity of automatic light control; for a printed list of orders received for "Newbridge" gas controllers since the middle of June last revealed the fact that the number of controllers involved ran into many thousands for this country. There have also been substantial orders from other countries. These controllers are made by British labour at the Company's factory—Newbridge Works, Bath—and it is claimed for them that they are quick and certain in action.

The requirements of suspension gas lamps are met by the firm.

Lighting Trades, Ltd. (incorporating J. & W. B. Smith, Ltd.), Oriel House, Farringdon Street, E.C.

Here there were featured "Renown" magnesia superheater cluster burners, which will not back-fire from any drop in gas pressure caused by fluctuations in pressure in service pipes. "Renown" cluster burners, being entirely made of magnesia, avoid all internal and external corrosion. The interior of the chamber is of special construction, whereby the mixture is improved and perfect burning is obtained.

Magnesia preheaters have been tested for the past two years; and their performance and durability are said to be satisfactory in every way. A test is in progress at present under strict street lighting conditions; and during a period of nine months the "Renown" clusters under test have not been reported for attention other than mantle renewals. The mantle average to date is less than 2·5 per annum per nozzle.

London Electric Firm, Croydon.

Here was to be seen an example of the firm's gas span-wire lowering gear, for easy cleaning of lamps.

Metropolitan Gas Meters, Ltd., Nottingham.

Still another controller was displayed here—this time the "Duplex" convertible gas lighter and extinguisher. While of extreme simplicity, it will perform many functions. For example, it can be set to operate once or twice in twenty-four hours at will. It can be set to light up at any time and to extinguish at any time after an interval of two hours, light up again at any time after an interval of a minimum of one hour, and extinguish again any time after an interval of two hours. It can be turned on by hand, if desired, without disturbing the normal sequence of operations. The amount of power required to operate the valve is very small. The valve can be cleaned if necessary without removal, and vibration of any description will not cause the mechanism to operate prematurely. There is a patented joint, permitting of controllers being interchanged without disturbing the connection to the service.

Municipal Supplies, Ltd., Salisbury Road, Edinburgh.

This firm supply the needs in all sorts of directions of public lighting authorities; and there were many interesting things on their stand, including magnesia superheater burners. Then there were a full range of Peebles mercury and diaphragm governors, and pressure gauges, together with a Peebles patent heat indicator—an appliance for testing B.Th.U. which is said to be most effective and exceedingly satisfactory in use. Here were also a series of non-combine mantles, together with a range of "Pyrex" heat-resisting glassware.

A decided novelty was the "Lucifer" inexhaustible dynamo pocket lamp, suitable for meter reading and other like purposes. It is always ready for instant use, and is an electric lamp without any battery or accumulator—an inexhaustible lighting plant generating its own electricity while held in the hand.

W. Parkinson & Co., London and Birmingham.

Parkinson street lamps are in many forms to suit varied requirements; and it is difficult to select one pattern rather than another for mention. A feature was, however, made of the "Blackpool" lamp for lighting arterial roads, and for obviating the dark space which is so frequently seen between one lamp column and another. The lamp carries eleven to fifteen preheated burners, arranged in three tiers; and it can be fitted with clock controllers, so that a pre-determined number of burners can be extinguished (say) at midnight, leaving the remainder alight. The new "Parade" lamp—which may also be fitted with a controller, and is made with from two to five nozzles—is a strong, serviceable looking lighting appliance. A small danger lamp has been designed for attaching to the arms of standards in island positions.

Messrs. Parkinson & Co. now supply burners metallized. This is an entirely new departure in the manufacture of gas burners, rendering them absolutely immune from the effects of the products of combustion, and preventing corrosion. A burner was to be seen which it was stated had been in use for 3000 hours—equivalent to twelve months' street lighting—and there was not a particle of deposit on it.

A. E. Podmore & Co., Charles Street, Hatton Garden, London.

This firm drew the attention of lighting engineers to the "Edinburgh" lamp fitted with "Gunfire" Controller and patent divided 3-light superheater for medium mantles. The clock can be fixed to light up the three mantles at (say) dusk, extinguish two at midnight, and the other one at dawn. This lamp is made in all copper, and can be supplied in 3, 4, 5, 6, or 7 light on the same principle. The "Tramway" 1-light lamp is a very imposing all copper lamp. It is entirely new and claimed to be thoroughly efficient.

William Sugg & Co., Ltd., Chapter Street, Westminster, S.W.

Taking them alphabetically, the last stand that calls for notice here is that whereon the public lighting specialities to which is attached the well-known name of "Sugg" were to be seen. Prominent among them was the "Promenade" lamp, with regard to which an interesting piece of news was gathered. It is that the Urban District Council of Penarth have entrusted the Cardiff Gas Company with an order to erect something over 400 lamps of the "Promenade" type, fitted with Horstmann automatic lighters and extinguishers. Another favourite is the "Littleton" lamp, which was shown with controller. The firm are making various danger signs, which present day traffic conditions call for.

A striking feature of the stand was a print, dated 1890, illustrating "Whitehall" lamps on Brighton front. There were, it is believed, about 200 of them; and when the members of the Institution were driving last week through Hove to the Portslade Gas-Works some of these "Whitehall" lamps were to be seen still bravely facing the sea.

Phenomena of Electrolytic Corrosion of Mains.—Great pressure on our space this week has unfortunately compelled the holding-over of the final instalment of M. A. Bolzinger's "Study of the Phenomena of Electrolytic Corrosion of Mains." It will appear in the next issue of the "JOURNAL."

Price of Gas Oil.—By driblets the price of gas oil is descending. From Sept. 7, the price was reduced by ¼d. per gallon, which makes the market quotation as follows: In rail tank cars—*i.e.*, 10-ton lots, 4¾d. per gallon; and in smaller quantities of 1000 gallons and upwards, 5d. per gallon, net and naked *ex* wharf.

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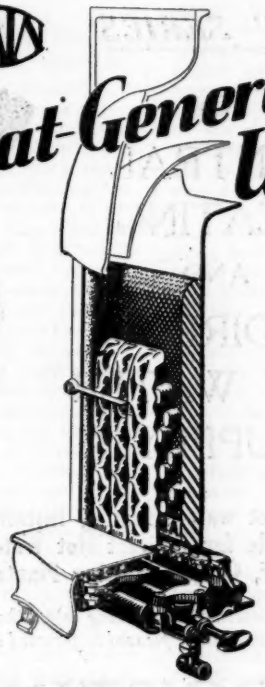

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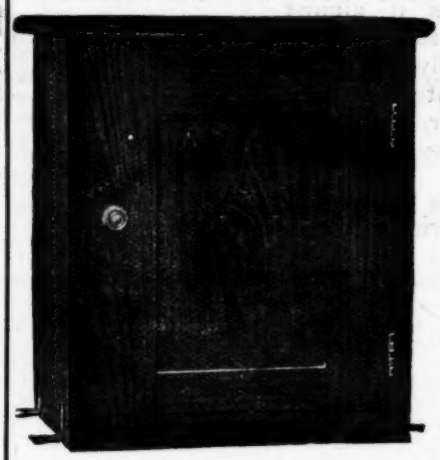

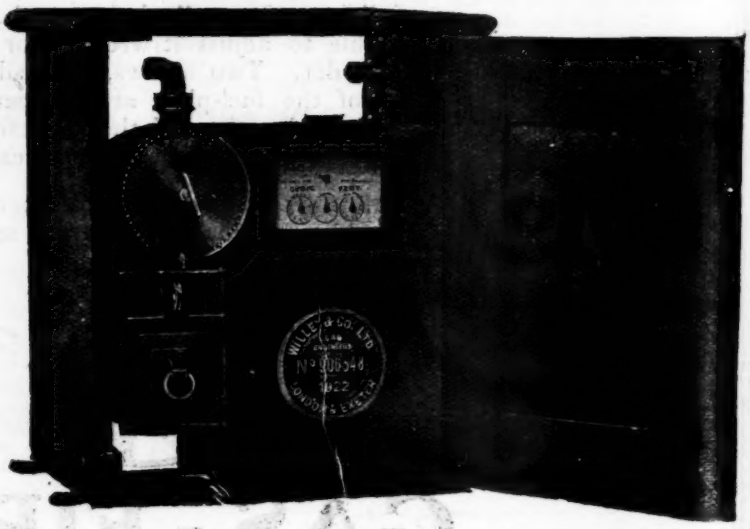

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DISCUSSION ON THE BRITISH ENGINEERING STANDARDS ASSOCIATION DRAFT SPECIFICATION FOR STREET LIGHTING.

By L. B. W. JOLLEY, M.A. (Cantab.), M.I.E.E, J. M. WALDRAM, B.Sc, A.C.G.I, and R. WATSON.

[Before the Institution of Public Lighting Engineers at Brighton on Sept. 13.]

INTRODUCTION.

The genesis of this specification may be found in the work of the British National Illumination Committee, which is a constituent member of the International Commission on Illumination.

The Committee, in preparing for its share of the 1924 Conference at Geneva, realized that, with fundamental principles, definitions, and nomenclature practically settled, work tended more and more to matters *inter alia* of standardization both nationally and internationally. So far as this country is concerned, the Association which has become the important and dominant standardization authority is the British Engineering Standards Association; and since there were several important questions which require, for the purpose of uniformity, the co-operation of manufacturers and users, the National Illumination Committee felt that the Association was not only the right, but the most suitable, body to undertake purely standardization subjects. The Committee therefore made a suggestion to the British Engineering Standards Association that they should add to their various Committees one for the establishment of specifications of instruments and appliances used for illumination purposes. It was further felt that grades of illumination such as may be used for factory lighting, street lighting, &c., as well as apparatus, should come within their purview.

The National Illumination Committee considered that specifications issued under the ægis of the British Engineering Standards Association would be considered more definitely national than otherwise might be the case, and, therefore, receive greater consideration at any international conference, or when compared with like specifications issued by other national bodies.

The British Engineering Standards Association gave favourable consideration to the request, and in January, 1924, established a Sectional Committee for the purposes outlined. This Committee had its first meeting in June of that year, and appointed, among others, a Sub-Committee to deal with street lighting with the following terms of reference: "To consider the best basis for the evaluation of highway lighting with special reference to motor traffic, and if possible to recommend standards for the same."

The Sub-Committee thus constituted was made up of representatives of the Illuminating Engineering Society, the Institution of Gas Engineers, the Institution of Electrical Engineers, the Institution of Public Lighting Engineers, the National Physical Laboratory, the Ministry of Transport, the Automobile Association and Motor Union, the Institution of Municipal and County Engineers, the Incorporated Municipal Electrical Association, the Royal Automobile Club, and the Electric Lamp Manufacturers' Association. The majority of the representatives appointed are members of the National Illumination Committee; and direct connection with the International Commission on Illumination is thus preserved. It was the intention that any specifications involving international agreement would be submitted by this Committee to the International Committee on Illumination.

It may be interesting here to refer to the attention paid generally to the subject by the International Commission on Illumination at their meetings in July of the same year—viz., 1924. Following the contribution of three papers on Street Lighting at that Conference, views were advanced that a legal minimum illumination for public streets should be determined, with the provision of as low a diversity as possible between maximum and minimum illumination. It was realized that it was difficult for any international body to make legislative suggestions, and it was decided to place the subject of street lighting on the agenda for the next triennial Conference; the various constituent National Illumination Committees being asked in the meantime to proceed with their deliberations on the question generally.

This reference to the work of the International Commission on Illumination is made for the purpose of indicating the possibility of co-operative consideration, or at any rate international comparisons and help. The draft specification now under consideration is, so far as British practice is concerned, the second of its kind.

In 1913 "Standard Clauses for inclusion in a Specification of Street Lighting" were drawn up by a Committee of representatives of the Institution of Electrical Engineers, the Institution of Gas Engineers, the Institution of Municipal and County Engineers, and the Illuminating Engineering Society. These were embodied in an able paper by Trotter at a meeting of the Illuminating Engineering Society held in the same year. The specification probably crystallized the views of that day as to what might be considered a reasonable minimum illumination for various classes of streets; and the grades based on the best practice in street lighting ranged from 0·01 foot-candle for the designated Class A streets to 0·10 foot-candle for Class E. These values were measured on a horizontal plane 3 ft. 3 in. above the ground-level. Circumstances, however, prevented this specification from coming into use.

Much has taken place since that time, and the need for higher grades of illumination has been accentuated by the enormous growth of fast-moving traffic. The present specification is necessarily in advance of the 1913 specification, and, as stated in its preface, provides standards and conditions which may not only suit existing street lighting requirements, but as far as possible anticipate what may be reasonably expected in the near future. In comparison with the provisions of the 1913 specification, it suggests higher standards of street illumination, and provides as far as possible for the better and more uniform distribution of that illumination on the surface of the street, by clauses covering the height of light units for each class, and their spacing in relation thereto. In addition to these provisions, some attempt has been made to obviate the possibility of objectionable glare which might result in any particular case.

In the light of past work, the magnitude of the task involved in the preparation of an ideal street lighting specification was obvious to the Sectional Committee on Illumination of the British Engineering Standards Association at their first session. With a keen appreciation of the difficulties, and after having carefully studied all previous data on the subject, the Committee were unanimous in its recommendation that in the present state of knowledge of what constitutes the desiderata of good street lighting, the starting-point for mandatory requirements was a classification of lighting installations or systems by means of the minimum horizontal illumination which should be permissible on the surface of the street in defined classes.

The specification, therefore, was prepared on this basis with provisions for securing as far as possible adequate and suitable distribution of illumination along the road surface in each of the classes referred to.

The specification was issued in draft form for general discussion. It received sympathetic support in principle and helpful criticism in detail. Discussion was essential if progress was to be expected, and those who laboured in the preparation of the specification welcomed the constructive criticisms, and especially the comments on those clauses of a more educative character. The latter are not usually to be found in British standard specifications; and they will, it is hoped, lead to a better understanding of a complex problem.

Needless to say, the criticisms have been carefully considered, and amendments made which will probably render the revised specifications generally acceptable. The alterations concern principally:

(*a*) The substitution of the term "test-point" for "mid-span point;" such test-points being shown in plans of typical installations.
(*b*) The addition of a Class H grade of installation having a rated mean test-point illumination of 0·01 foot-candle for residential and other streets where through traffic is not ordinarily expected.
(*c*) Some variation of the tolerance in illumination under rated conditions permitted in any section of street treated.
(*d*) The modification of the apparently mandatory character of the glare clause.

The present paper deals with the specifications thus amended.

VARIABLES IN A STREET LIGHTING INSTALLATION.

It is considered vital that a clear perception of all the variable factors in this complicated problem should be entertained and maintained by all interested in the subject; and as the mathematical analysis is by no means difficult, it has been considered advisable to discuss these factors in detail.

The variables in the installation which are to be considered are as follows:

e_m = the illumination at a test-point (Definition 4).
E_M = the mean test-point illumination as given in Table I. in the specification.
E_{min} = minimum illumination on the surface of the street.
E_{max} = maximum " " " " "
E_{av} = average " " " " "
$\Delta = \frac{E_{max}}{E_{min}}$ = diversity.
h = the height of the source of light above the ground.
l = the spacing.
d = the distance from the point on the ground under the light source to the test-point.
w = the width of the street.
$r = \frac{l}{h}$ = spacing-height ratio.
$R = \frac{2d}{h}$ = the equivalent spacing-height ratio.
I_o = the luminous intensity in the direction of the downward vertical.
I_θ = the luminous intensity at any angle θ to the downward vertical.
I_ϕ = the luminous intensity in the direction of the test-point.

Other variables of a more nebulous character are:

The reflection characteristics of the road:

ρ_1 = the reflection factor of the road surface under given conditions and in a stated direction.

ρ_2 = the reflection factor of an object.

B_{max} and B_{min} = the maximum and minimum brightnesses of the road, as seen by an observer in a given position.

B_o = the brightness of the object.

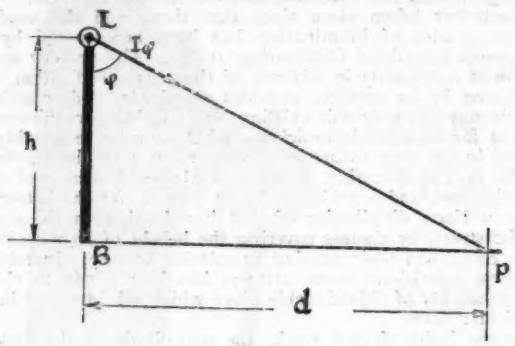


Fig. 1.

In fig. 1 a light source L is shown in relation to the test-point P. The illumination on the horizontal plane at the test-point due to two such symmetric light sources is

$$e_m = \frac{2I_\phi \cos^3 \phi}{h^2}$$

where $\phi = \tan^{-1}\frac{d}{h}$

The illumination at B due to one light source is

$$E_{max} = \frac{I_o}{h^2}$$

contributions from other light sources being assumed to be negligible.

In cases where the light unit is directly mounted on a spigot, the luminous intensity immediately underneath the post is low, and the latter equation is not strictly correct. For the purpose of this argument, however, it is sufficiently accurate to assume that I is the greatest luminous intensity between 0° and 20° from the vertical.

$$\text{Since } R = \frac{2d}{h}$$

$$\cos^3 \phi = \left\{1 + \frac{R^2}{4}\right\}^{-\frac{3}{2}}$$

and therefore

$$e_m = \frac{2I_\phi \left\{1 + \frac{R^2}{4}\right\}^{-\frac{3}{2}}}{h^2} \quad \ldots\ldots\ldots \quad (1)$$

It is shown later that e_m is approximately equal to E_{min} It will be seen from equation (1) that provided the equivalent spacing-height ratio R remains constant, the minimum illumination is inversely proportional to the square of the height of the light source; and as

$$\Delta = \frac{E_{max}}{E_{min}} = \frac{I_o}{2I_\phi}\left\{1 + \frac{R^2}{4}\right\}^{-\frac{3}{2}} \quad \ldots\ldots\ldots \quad (2)$$

the diversity is dependent only on the equivalent spacing-height ratio and the light distribution of fitting employed.

Further, an alteration to the value of R affects the value of E_{min} in a complicated manner, as it involves an alteration in the angle ϕ, and therefore introduces the distribution of luminous intensity.

Excepting where streets are wide in relation to the spacing, it will be evident that R is only slightly greater than r, and, therefore, that for the purpose of the following arguments,

$$E_{min} = \frac{2I_\phi \left\{1 + \frac{r^2}{4}\right\}^{-\frac{3}{2}}}{h^2}$$

and

$$\Delta = \frac{I_o}{2I_\phi}\left\{1 + \frac{r^2}{4}\right\}^{-\frac{3}{2}}.$$

Generally speaking, the effect of increasing the spacing-height ratio is to decrease the minimum illumination and to increase the diversity. If the height remains fixed, the maximum illumination is unaffected.

Intensity of Illumination.

The intensity of illumination expressed in foot-candles is applied in several ways in the definitions in the specification.

If e_m is the horizontal illumination of a test-point (the actual definition of test-point being that accepted in the specification, it is apparent that owing to fortuitous circumstances, such as variations in supply pressure, manufacturing tolerances in the lighting unit, and the like, e_m will not be the same for all test-points, and that a more accurate measure will be the definitional horizontal mean test-point illumination E_M, where E_M is the average of the horizontal illuminations at five test-points.

It should be noted that in the case of a symmetric distribution of luminous intensity—viz., in that case where the solid polar curve is one of revolution of a plane figure about the vertical X O X, as shown in fig. 2, the horizontal illumination at a test-point e_m will be approximately the minimum horizontal illumination E_m in a span, if the definitional test-point is accepted.

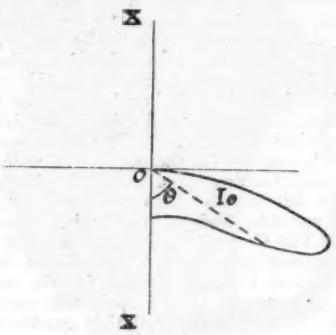


Fig. 2.

For the purpose of this discussion, therefore, assume that E_M is equal to the minimum horizontal illumination E_{min} and to the illumination at any one test-point e

There are many who would press for the inclusion in the specification of a measure of the average illumination E_{av}. Theoretically the suggestion may be a sound one, but the practical difficulties of ascertaining even an approximate value of E_{av} by measurement in the street are considerable.

Furthermore, if any required value of E_{av} is included, the designer will be severely hampered; and it may happen that such requirements will conflict with some of those already specified.

The following formulæ are useful in ascertaining the approximate value of E_{av}, and indicate the difficulty of dealing with this quantity:

For staggered or one side spacing.

$$E_{av} = E_{min}\left\{0{\cdot}91\ \Delta\ h^2 + (1 + 0{\cdot}09\ \Delta)\ \ (wl - \frac{\pi h^2}{2})\right\}$$

For central spacing.

$$E_{av} = E_{min}\left\{1{\cdot}82\ \Delta\ h^2 + (1 + 0{\cdot}09\ \Delta)\ \ (wl - \pi h^2)\right\}$$

For double side spacing.

$$E_{av} = 2E_{min}\left\{0{\cdot}91\ \Delta\ h^2 + (1 + 0{\cdot}09\ \Delta)\ \ (wl - \frac{\pi h^2}{2})\right\}$$

Out of the illumination factors which enter into each street lighting installation, the Committee picked on the horizontal mean test-point illumination E_M, not as a criterion of excellence, but as a method of classifying installations. The distinction is important, and may be exemplified by the familiar illustration of a size in hats representing a classification without providing a guide as to excellence. However, it must be borne in mind that the problem, though apparently simple, is one of great intricacy; as it is found that if too many variables are specified, the requirements will be conflicting.

Having determined the classification of installations, and assigned limits to the value of E for each class, the Committee would have liked to take one step further, and correlate the classifications A, B, C, &c., with grades of thoroughfare. This was found, however, to be practically impossible at the present time. The specification attempts among other things to legislate along sound lines for the future; and it was felt that it would expound itself in the light of future experience, and any attempt to correlate types of streets with the classification would tend to restrict rather than aid development. Thus these classes aim at higher minima of horizontal illumination than are to be found as a general rule to-day; in fact, class A borders on spectacular lighting according to our present views.

Since the draft specification was first issued, a class H installation with a minimum illumination of 0·01 foot-candle has been added to cover the many residential streets which are not used for fast-moving through traffic. This minimum illumination in a class H installation, covered as it is by improved spacing height ratio, and measured at ground-level rather than at the old height of 3 ft. 3 in., may be considered by many as sufficient for the streets referred to.

Height.

The next factor in order of importance is that of the height of the light source above ground-level. From the point of view of glare, it will at once be agreed that the higher the source of light, the less the glare on the eye; but, on the other hand,

the illumination varies inversely as the square of the height, and thus a compromise has to be effected. A table of heights has been included as a mandatory condition of the specification, which with present information represents the limits which may be considered reasonable.

Spacing Height Ratio.

The importance of the spacing-height ratio has been already shown by the analysis above. It is this ratio more than any other single factor which determines the distribution of illumination on the road. The effect of a large value of the spacing-height ratio is to produce a low minimum and a high diversity, and generally necessitates the employment of directive equipment giving a high value of luminous intensity at an angle just below the horizontal. Under these conditions the proper maintenance of the apparatus is difficult, as careful focussing of the light source is required. If the maintenance is carelessly performed, the installation will fail to pass Clause 12 (Service Illumination), and severe glare may result owing to a high value of luminous intensity being emitted in the wrong direction. At the same time, a low value of the spacing-height ratio leads to a costly installation, as it involves either high posts or a large number of units; and thus it is naturally desirable to use as high a value as is consistent with proper illumination of the road.

With these points in view, the Committee has set an upper limit to the spacing-height ratio, which is not a recommended value, but is a figure which the designer must in no event exceed.

Diversity and Brightness Contrast.

An object (such as a pedestrian) of brightness B_o candles per sq. in. will become apparent as it is seen against the light and dark patches on the road which have brightnesses of B_{max} and B_{min} respectively.

Objects generally appear dark on a light background; but if the object happens to be so illuminated that its brightness is just intermediate between those of the light and the dark patches, then the contrast which it presents will be a minimum. For the value of the contrast

$$K_{min} = \frac{B_{max} - B_o}{B_{max}} \quad \text{and} \quad \frac{B_o - B_{min}}{B_o}$$

for the light and dark patches respectively. For the condition of minimum contrast these are equal, whence

$$\frac{B_o}{B_{max}} = \frac{B_{min}}{B_o} \quad \text{or} \quad B_o = \sqrt{B_{max} \times B_{min}}$$

But $$\Delta = \frac{E_{max}}{E_{min}} = \frac{\pi \rho_1 B_{max}}{\pi \rho_1 B_{min}} = \frac{B_o^2}{B_{min}^2}$$

for a matt road; and the minimum contrast

$$K_{min} = \frac{B_{max} - B_o}{B_{max}} = 1 - \frac{1}{\sqrt{\Delta}} \quad . \quad . \quad . \quad . \quad (3)$$

Since an object is more readily visible as the contrast which it presents is greater, this indicates at once the important influence of diversity on the visibility in the street—viz., the greater the diversity, the greater the minimum contrast, and therefore the visibility under the most adverse conditions.

Further, let $\frac{I\phi}{I_o} = m$, the magnification ratio of the particular fitting, which in well-designed fittings varies from about 3 to a maximum of 10; whence, eliminating Δ from equations (2) and (3), the least contrast

$$K_{min} = 1 - \sqrt{2m} \left\{ 1 + \frac{r^2}{4} \right\}^{-\frac{3}{2}} \quad . \quad . \quad . \quad . \quad . \quad (4)$$

This equation, though approximately accurate in its physical basis, must be accepted with considerable reserve in its application to visibility in a street. It applies only to one or two isolated conditions in the span in which an object, by reason of its reflection factor and position, is peculiarly difficult to see. It does not apply when the street width is such that the light patch near the lamp does not extend across the road, or when the road surface is otherwise than matt; neither does it take any cognizance of the fact that at another position in the span the same object might be easy of observation. But it does appear to indicate (with our existing knowledge) that an increase in the spacing-height ratio is not *per se* an objectionable feature, and may be the reverse within certain limits.

In the specification the only obligation in regard to spacing-height ratio is that it shall not exceed a given value; and it will be seen from fig. 3, which is a graph of equation (4) for $m = 3$, that on this basis there is little gain from an extension of the value beyond 12.

It must be borne in mind, however, that, if r is increased, then, to obtain the same illumination, increased luminous intensity will be required per fitting. Further, an increase in r tends to too much glare.

Having considered the variables in the problem, it will be apparent that for the purpose of classifying installations the horizontal mean test-point illumination is the most suitable quantity, but that it must be accompanied by other obligatory

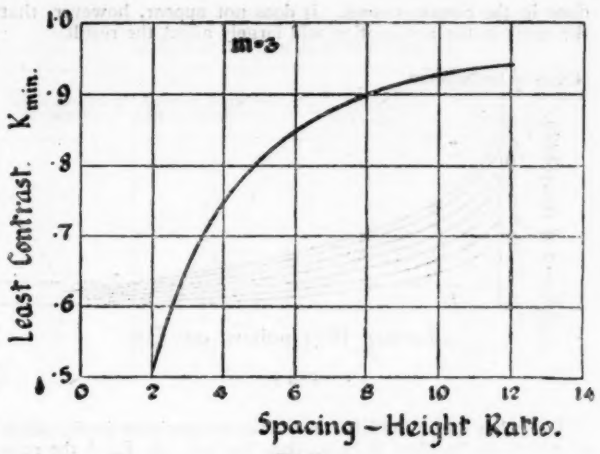


Fig. 3.

clauses, carefully chosen so as to present no conflict of requirement.

Glare and Visibility.

The effect of a glaring source on visibility is a question which has engaged the minds of many in this country and abroad; but so far it has not been possible to reduce it to a matter of facts and figures. Glare is only dangerous in so far as it is deleterious to vision. The man in the street knows what he means by glare, but the specification considers something which is only one aspect of glare—viz., its deleterious effect on ocular sensitivity.

The fundamental basis of the clause in the specification is a method devised by Walsh based on the experimental work carried out by Bordoni on the effect of a glaring source of light on the perception of contrast. A determination was made of the least perceptible contrast under varying conditions of glare; and in order to express the ability of an observer to perceive contrasts, a function known as the coefficient of perceptibility p (the reciprocal of the least perceptible contrast) was used; so that

$$p = \frac{B_1}{B_1 - B_2}$$

where B_1 and B_2 are the brightnesses of two parts of a contrasting field which can just be distinguished from each other under given conditions.

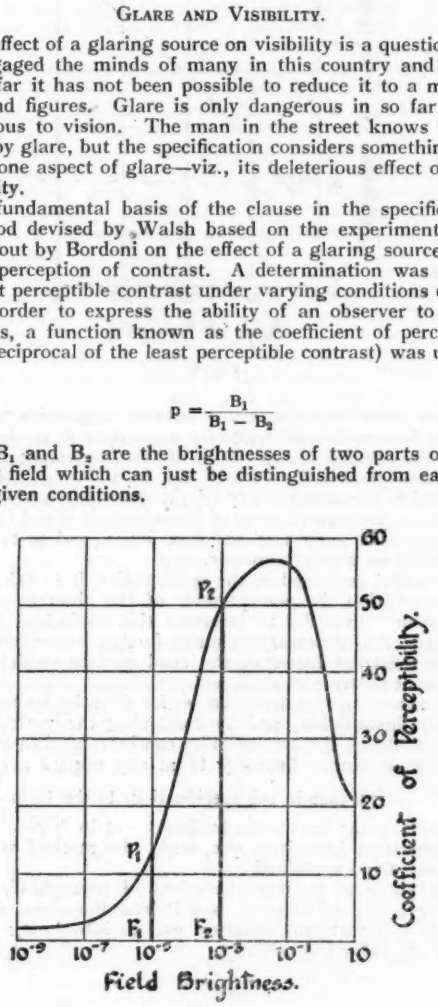


Fig. 4.

In fig. 4 the relation between perceptibility and field brightness is given, where the range of field brightness in street lighting practice is in the region of F_1, F_2.

If a glaring source is introduced into the field so as to produce an illumination on the eye, the perceptibility is decreased in accordance with the curves given in fig. 5, where the initial ordinates OA, OB, &c., represent the perceptibility for the various classes of installation under a condition of no glare, and are obtained directly from the fundamental curve in fig. 4. As the curves are followed to the right from the points A, B, C, &c., the perceptibility becomes less and the light source becomes more glaring as the illumination on the eye increases. Only one of these curves has so far been obtained experimentally by Bordoni; the others being calculated by direct proportion. This calculation is not strictly correct, but is all that can be

done in the circumstances. It does not appear, however, that the error in the assumption will largely affect the result.

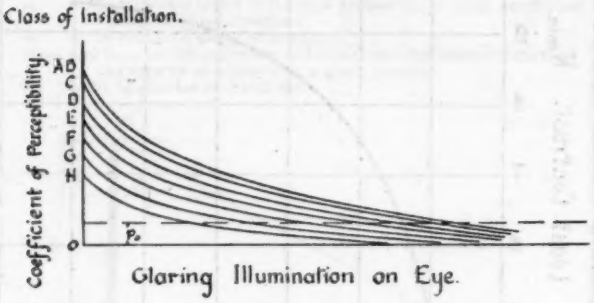


Fig. 5.

The other factor which enters into the problem is the angle at which the incident light reaches the eye. In fig. 6 the relation between this factor and the perceptibility is shown.

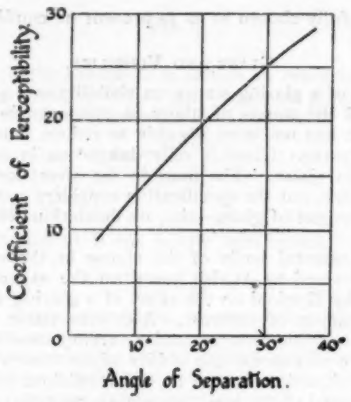


Fig. 6.

Bordoni found that the results were not applicable to sources of light which subtended a greater angle than 3° at the eye.

The ideal method of application of this fundamental research would doubtless be to ascertain and fix a limit p_o (see fig. 5) below which the perceptibility of the observer should nowhere fall; but in the present state of knowledge it is not considered fair to prescribe such hard and fast limits, and so to penalize installations on slender grounds.

The method employed in the specification is to calculate for every installation the perceptibility of the observer anywhere in the span. In order to calculate this coefficient from the above data, it is necessary to make further assumptions—viz., that the reflection factor of the road surface (which is considered to be matt) is 10 p.ct., and that $B_{mean} = 0{\cdot}6\ \Delta\ \rho_1\ E_{min}$. Then by assuming reasonable values for diversity for the various classes of installation, and by combining the various curves mentioned above, the perceptibility can be related to the height and to the luminous intensity $I\theta$ at any angle θ; or if preferred, as is the case in the specification, to the term $\frac{I\theta}{h^3}$.

By these means the curves in figs. 8—14 in Appendix IV. of the specification have been prepared; the method of employment being there explained.

A low value of p_o, the coefficient of perceptibility, corresponds to a glaring source; and it was therefore considered advisable to invert this criterion and to introduce a new coefficient of ocular insensitivity,

$$G = \frac{100}{p_o}$$

and the values of the curves in figs. 8—14 in the specification represent the calculated values of G for each class of installation.

As explained in the specification, a polar curve of the fitting which intersects a curve on the diagram enables the value of G for a particular angle to be obtained. The minimum value which is at present considered glaring corresponds to a maximum value for G of 10.

The difficulty, which is being investigated at present, is that when the value of G, calculated as above, is plotted along the span, various curves, as in fig. 7, may be obtained for different installations; and it is difficult to assess a true value for the over-all glare of an installation in the ordinarily accepted sense of the word.

Thus the problem of glare is by no means settled from the viewpoint of fundamental experiment. Work along these lines is in progress at the National Physical Laboratory, and will be

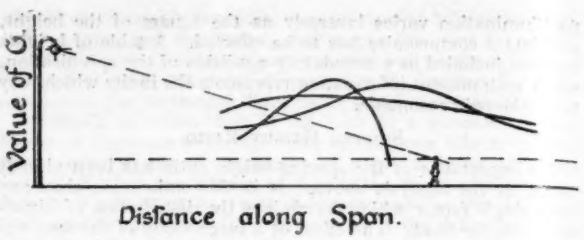


Fig. 7.

of interest when the results are available. At the same time more practical road tests are being undertaken to ascertain how far the actual street measurements confirm the fundamental investigation.

No mention has been made of the number of problems which arise when the road surface becomes shiny by reason of wet or by the effect of traffic. In the authors' view, the factor of most importance in this case is not so much the intensity or distribution of the illumination on the road surface as the position of the light source relative to the road and the observer, particularly on curved roads.

Preliminary surveys have been made of various London streets, so that those engaged on the researches might familiarize themselves with the types of lighting at present installed; and at the same time a check has been carried out on the validity of the theoretical methods of calculation.

Non-Technical Requirements.

The above completes a description of the technical and scientific data which had to be considered by the Committee before the draft could be submitted. There are other matters, however, relating to definitions, testing, and the like, which must receive attention, as they are of importance in the application of a specification to practical affairs.

Test-Point.

It is important to bear in mind that the test-point is an arbitrary geographical point which is specified as to its position in the illustrations in the specification. Generally, it is in the region of lowest illumination, though not necessarily situated precisely at the point of minimum illumination. Some criticism has been levelled at the diagrams in figs. 2—6 in the specification, in that the points T or T' are situated on the kerb line; and it is necessary to explain that this is not due to a desire to prescribe little or no illumination on the pathway, but chiefly to the inadvisability of measuring illumination close to walls, buildings, &c., owing to light reflection and other practical difficulties. Thus it was considered advisable to fix the test-point in figs. 2, 4, 5, and 6 on the kerb line.

Rated and Service Illumination.

In order to distinguish between supply and maintenance, clauses have been inserted dealing with "rated" and "service" illuminations; and in both cases a tolerance is allowed (see clauses 11 and 12). Thus the classification relies on a value of E_m, and at the same time a tolerance is given on e_m.

Tests.

The two tests of illumination values at the test-point under rated and service conditions respectively aim at a distinction between the supply of fittings, &c., by a manufacturer and a maintenance of luminous output by a local authority. Thus it will be unfair under rated conditions to penalize the manufacturer of a fitting for a fortuitous variation in supply pressure losses due to depreciation in luminous intensity, lamp adjustments, and the like. Further, it is often difficult, if not impossible, to obtain a true measure of the supply conditions so as to make the necessary corrections to the luminous output; and thus arrangements have been made for the rated test to be made (if so desired) in the laboratory, under such conditions as will result in a mean figure for the rated mean test-point illumination. This test will probably become the regular "rated" test, as it is more precise in its operation and certain in its application.

Tests under service conditions, though they cannot be applied in the laboratory, should, it is hoped, prove beneficial to the community in providing for the desired maintenance of the specified illumination.

Conclusion.

The chief technical and non-technical points in the specification have been reviewed; and it will be apparent that it attempts to fulfil a threefold obligation for:

(1) The purchase of a scheme of lighting for any defined class on sound scientific lines, by the street lighting authority from manufacturers of appliances.
(2) The maintenance of such an installation by the street lighting authority for the public.

(3) The education of all concerned in problems of street lighting which are at present but dimly understood, and which should be fully appreciated if progress is to be made.

APPENDIX A.—TESTS ON GLARE.

The method of calculation given in Appendix IV. of the specification is based entirely on laboratory results; and, as has already been indicated, before such a method was included in the draft specification, it was considered advisable to ascertain whether or not its inclusion was justifiable. A test was arranged for this purpose.

The problem was twofold: In the first case it was necessary to determine whether the calculated values of perceptibility agreed with the observed; and, secondly, to ascertain whether the quantity chosen as a criterion of glare—namely perceptibility—agreed substantially with the conception of glare entertained by ordinary users of the road.

A number of installations of various types in London were visited, and at each installation a threefold observation was made as follows:

(*a*) Particulars of mounting, height, spacing, and minimum illumination were taken, from which the values of G were calculated according to the method of Appendix IV. of the specification.

(*b*) The observers (six in number) were asked to record their opinions of the glare from the installation, when standing approximately at the position of maximum glare.

(*c*) The perceptibility of the observers was ascertained approximately by direct experiment, using a special test object by which a variable and known contrast could be presented.

In view of the approximate nature of the test, which was only of a preliminary character, precise results were not to be expected; but it was considered that if the orders of preference of the installations as determined

(*a*) by calculation,
(*b*) by opinion of the observers, and
(*c*) by experiment

were found to be approximately the same, then there would be some justification for the method given in the specification.

Schedule II. has been plotted in the form of curves in fig. 8, which indicate graphically the extent of the agreement between the three methods.

Though the agreement is by no means perfect, the three curves have obviously the same general tendency to rise or fall together, indicating the existence of some relation between the three determinations.

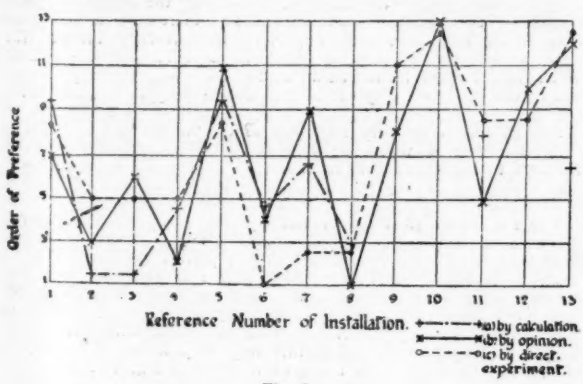


Fig. 8.

SCHEDULE I.

Particulars of Installations.

Reference No. of Installation.	Thoroughfare.	Height of Light Source above Ground.	Spacing in Ft.	Mid Span Horizontal Illumination at Time of Test.* Foot-Candles.
		Ft. In.		
1	Marylebone Road	11 6	114	0·02$_8$
2	Baker Street	23 0	150	0·07$_5$
3	Waterloo Bridge (new)	25 0	144	0·05$_8$
4	Farringdon Street	25 6	178	0·07$_5$
5	Dalston Lane	20 6	260	0·02$_1$
6	Strand	25 0	113	0·6
7	Regent Street	21 0	146	0·07$_5$
8	Oxford Street	26 0	158	0·05$_2$
9	Exhibition Road (South Kensington)	..	..	..
10	Sinclair Road (West Kensington)	9 0	129	0·005
11	Castlenau, Barnes.	13 6	170	0·007$_5$
12	Lavender Hill	22 4	126	0·01$_4$
13	High Street (Watford)	18 9	173	0·02$_0$

*These readings were not taken at the test-point, but at the mid-point of the span.

SCHEDULE II.

Orders of Preference of Installations.

Reference No. of Installation.	Order of Preference (*a*) by Calculation.	Order of Preference (*b*) by Opinion of Observers.	Order of Preference (*c*) by Direct Experiment.
1	9½	7	8½
2	1½	3	5
3	1½	6	5
4	4½	2	5
5	9½	11	8½
6	4½	4	1
7	6½	9	2½
8	3	1	2½
9	..	8	11
10	..	13	12½
11	8	5	8½
12	..	10	8½
13	6½	12	12½

The paper was presented by Mr. L. B. W. JOLLEY.

A JOINT GAS AND ELECTRICAL PAPER.

Mr. ROBERT WATSON (Doncaster) said that the paper had probably been in the hands of members for some days; and it had been admirably summarized by Mr. Jolley, to whose remarks he did not think he could usefully add much at that stage. He felt happy in being associated with Mr. Jolley and Mr. Waldram; but he must confess that they had done the major portion of the work entailed in the preparation of the paper. The association was a pleasing one to him, not only on account of personal friendship, but also because this, he thought, was the first occasion, or at any rate one of the first occasions, on which gas and electrical interests had been associated in the joint authorship. He trusted it would not be the last occasion. ["Hear, hear."] They all recognized that their respective industries had fields of their own; and he believed they would work happily and well together in the future. The Street Lighting Specification Committee had had many meetings, and had spent long hours in the preparation of the specification. They issued early in the year the result of their efforts. That early draft had been subjected to very helpful criticism and comments from various organizations. Thus they had had the advantage, not merely of the opinions of the representatives of the different bodies on the Committee itself—including the representative of their own Institution, in the person of Mr. Liberty—but of those of other people which had been communicated to them and considered at subsequent meetings of the Committee. Probably this was the first opportunity for the final specification which had been issued to be presented at a more or less public meeting for the purpose of getting further help from gentlemen who were practically interested in lighting practice. This was not a case in which too many cooks could spoil the broth. The specification could not claim to be complete or even final. The complexities of street lighting were very great, and there were many points yet which would have to be considered.

Mr. J. M. WALDRAM then dealt in some detail with certain aspects of the paper, and with a number of photographic slides which were submitted for the inspection of the members. He pointed out that no photographs could by any means reproduce glare conditions. They could not show the effect of glare on the eye, because the effects of it on the eye and on a photographic plate were absolutely different. It would be a pity, therefore, if they attempted to judge the glare effect of streets by photography.

Discussion.

Mr. J. F. COLQUHOUN (Sheffield) regarded the specification as a monumental work. It was a milestone in the science of street lighting. To his mind it was the most important event in connection with street lighting that had happened for many years. Those who had laboured so arduously in the preparation of the specification were deserving of the warmest gratitude. The difficulties to be overcome must have been enormous; but the result was worth all the labour. Anything he might have to say would not detract in any way from his high appreciation of the work that had been done.

MINIMUM HEIGHT OF LIGHT SOURCE.

In Table II., he observed that a new class—Class H—had been added; and there had been a slight modification with reference to the minimum height of the light source above the ground for Class G. In the first place, the minimum height for Class G was a mere recommendation; now it was a mandatory 13 ft. The great majority of street lamps throughout the country had a light point roughly 11½ ft. above the ground. In many cases the minimum illumination came within Class G, but the standard was not 13 ft. high. They were now to be outside that class. He confessed that he had some misgivings as to this. In order to see the effect, he went to the trouble of raising the height of some standards to the required minimum for this class; and he admitted that he thought the result rather better. But he was not helped very much by Schedules I. and II., where the first installation quoted had the light source at a height of 11 ft. 6 in. above the ground, and was therefore outside the specification. He felt prepared to advise his own people to go to the expense of raising the height of the standards; but he wanted a good case, and the particulars of these installations had not given

him that case. Further consideration was required to be given to this matter. There were many hundreds of thousands of lamp standards throughout the country; and they must be absolutely certain of their ground before asking for the expenditure of the huge sum that would be involved in altering those that were outside the specification. Another point was that in the case of many of the new roads there was first the kerb, then a grass margin, and after that the footpath. What was to happen to the lighting of the footpath? Either it must be considered as a distinct lighting installation or the lighting of the roadway must be of such a nature as to be sufficient for both. He had an instance in mind in which there was the roadway, then a grass margin, after that a tramway track, and lastly the footpath. It would be quite possible to light the carriageway efficiently and leave the footpath in absolute darkness. There were, however, still a few pedestrians left; and they were entitled to consideration. The more they discussed the question of glare, the more confused they seemed to get. ["Hear, hear."] He had come across cases of quite obvious glare; and yet when he consulted a variety of motor drivers, they seemed to be wholly unconscious of the glare, even when it was pointed out to them.

Mr. JOLLEY interposed the remark that Schedules I. and II. had been included in the paper to back-up a particular curve (fig. 8).

Mr. HADYN HARRISON said the "B.E.S.A." specification was a young thing; but it was going to be an extremely valuable asset to street lighting—especially if that Institution did its best to make use of it. It had been most difficult, in the whole history of street lighting, to get a movement ahead (largely, they had been told, because of financial considerations); but now things seemed more hopeful in this respect. He was one of the people who agreed that much had taken place in a very few examples; but generally speaking much had not taken place.

1891 AND 1927.

In his original paper read in 1891, Mr. Trotter quoted certain examples of streets where the illumination was tested; and he gave several instances in which it was 0·005 foot-candle. Mr. Trotter described this as being the very lowest possible to be considered. If they could turn to Schedule I. of the present paper, they would find an example still existing of 0·005 foot-candle. In other words, in 1891 many streets were lighted equally as well as in 1927. This he regarded as an anachronism. What was wanted in connection with lighting was progress which was visible without need of instruments. People should be able to see with the naked eye that the lighting was better than before. Progress had taken place in many cases; but though the number was great, the area covered was not. In London they could pick-out a few miles of very respectable lighting; but over hundreds of miles they could not find any more. In the Provinces it was better in some respects than in London, except for these few centres. He had often spent his evenings in different large towns going round and seeing what had been done. Progress had taken place in a great many well-known cases; but it was not general. Progress was what he hoped the street lighting specification would help to further. The specification started-off with rather a millstone round its neck—or should they say a very "inflamed appendix?" [Laughter.] The question of glare had given the Committee a tremendous amount of work; and the appendix relating to this was nearly as big as—he was not sure that it was not bigger than—the specification itself. It was a most difficult problem; and they had not yet got to the bottom of it.

THE FINAL JUDGMENT.

Road surface conditions, of course, they had no control over. It might rain—it generally did—but it might also be fine, and they could not help it. But what was worse now was that the roads were nearly all black. In the old days a macadam street would have the appearance of a well-lighted thoroughfare, whereas with tar paving under exactly the same lighting conditions there was the impression of an insufficiently lighted street. This was why appearance did not help them very much on the scientific side, though it was bound to affect the final judgment, because street lighting would in the end be judged by the majority. It was interesting to note the views of the six observers on the question of street lighting. Those who knew London, and were familiar with the streets visited, could form their own opinions; but it would be seen that in order of preference these observers did not place the most highly illuminated street—the Strand—at the top of the list. Neither did the least illuminated street come at the bottom. In other words, the judgment of the multitude was not the result which they would arrive at by test. They knew that illumination was a very important factor; but it was not the only one. Unfortunately, in the street lighting specification they could not handle all these factors. They had to take one, and one only; and the one they had taken was minimum horizontal illumination, which was the basis of all the others.

Mr. E. J. STEWART (Glasgow) expressed his appreciation of the enormous amount of work that had been done in the preparation both of the specification and of the paper. It was very helpful to know that the specification was on a mathematical basis, even though they did not need to bother about this mathematical basis themselves. The essential point about the specification was that they had now got down to a figure basis for their street lighting. They had got to the horizontal foot-candle illumination, and in this way the specification followed-up the other specification with which the Institution had to do—the specification for the portable photometer. They must, in order to apply the street lighting specification, measure their light; and the other thing was that they must buy a portable photometer. Another important point was that they had now got a measure for glare; and also they had visibility put in as a criterion of street lighting. On the subject of glare, he would like to point out that the motorist looked more at the surface of the road than at the light source, which perhaps explained why he did not complain. He thought the time was hardly ripe for full treatment of the subject under discussion. In a year or two, after lighting engineers had had some experience of the specification, and its difficulties, and so on, they might be able to carry the matter further, either by discussion or by the gathering-in of reports.

Mr. J. S. DOW (Illuminating Engineering Society) said he was very glad to have an opportunity of speaking, because, as he was not associated with the preparation of the specification, he could make full acknowledgment of the good work that had been done by the Committee, and the clear and simple way in which the specification had been drafted. He felt some little doubt on the subject of glare. The authors dealt with this in a very ingenious manner, and deserved credit for their attempt; but people were a long way yet from really understanding the matter. Glare was defined in a great many different ways. He did not want the impression to go out, as the result of statements in the paper, that it was not necessary to shade the lights; the diffusion of light was one of the most important points to be aimed at in street illumination. Discussing the lighting of the lesser streets, he said the minimum lighting value mentioned in the specification was 0·01 foot-candle; but he considered that a value of 0·01 foot-candle was hardly worth specifying. It was in the lesser streets that the chief danger arose, and where a general increase in illumination was called for. The grading of illumination, to eliminate danger arising from alternate light and comparatively dark areas, should be dealt with; and he regretted that it had not been possible to insert a grading clause, so as to avoid sudden patches of brightness and darkness, because this was highly important.

Mr. LEON GASTER (National "Safety First" Council) remarked that he had just returned from Bellagio, where an International Illumination Commission had been at work; and the matter of street lighting had been referred-back for further consideration and report, for the reason that America had a standpoint different from that of England, Germany was somewhere between the two, and so on. With regard to the present "B.E.S.A." specification, he expressed the hope that next year there would be a practical paper showing what it would actually cost to convert existing streets from their present standard to their proper standard under the specification. The latter was not by any means perfect; but it formed a good basis upon which to proceed.

NEED FOR UNIFORMITY.

Mr. H. DICKINSON (Liverpool) said it must be clear to all that, with the tremendous growth of the traffic and the great increase in speed of that traffic, it was absolutely essential that much more attention should be paid to the lighting of the streets than had been the case in the past. The whole subject was very intricate, and the streets themselves were very irregular in form; but he did think the specification was going to perform much in impressing upon everybody the necessity for uniformity. If the specification did no more than create greater uniformity between the methods of one authority and another, it would have been well worth while. Glare was a most important consideration to motor drivers; and he thought there was much to be said for raising the light point, so as to minimize the effect of glare.

Mr. E. STROUD (Holophane, Ltd.) said the issue of the specification would give a valuable lead to lighting authorities; and its adoption would have the effect of increasing the height of posts, decreasing the distance between them, and increasing the illumination at the mid-span, thus improving the diversity factor. The authors of the paper seemed rather to have stressed the troubles which might occur as the result of the use of directive appliances; but he did not think they meant that directive appliances should not be used.

Mr. E. FRYER (Deputy Secretary of the Automobile Association) suggested that it would be well to get the specification carried through to demonstration, so that they could push forward.

SPECIFICATION NOT FINAL.

The PRESIDENT (Mr. A. C. Cramb) said many members seemed to be rather worried as to whether the specification was absolutely final. As with other things, a 100 p.ct. perfect specification would never be reached; but they could get to a stage which was good enough to go on with, and it was only by doing this and gaining experience that they could progress further. They regarded the specification as being sufficiently good to go on with. It was to be put into operation; and in this way they would obtain experience which would enable them to improve it still further.

REPLIES BY THE AUTHORS.

Mr. ROBERT WATSON said he knew his colleagues would join him in expressing hearty thanks for the kind reception that had been accorded the paper. It was gratifying to find that, generally speaking, the members were in agreement with the specification as a whole, though everyone was ready to admit that it was impossible to get a 100 p.ct. perfect specification. The present document had gone sufficiently far forward to warrant its acceptance, and to give some hope of further progress in the future. It might prove, as had been said, a very good means of inducing lighting authorities to adopt higher grades of illumination, and to improve street lighting generally, for the benefit of social amenities and particularly as a safeguard against accidents. There were just two or three points to which he would like briefly to refer. One or two speakers had alluded to the addition, since the specification was first issued, of a Class H, which embraced a minimum illumination of 0·01 foot-candle; and one gentleman had remarked that this class of illumination was hardly worth considering. He (Mr. Watson) happened to be one on the Street Lighting Committee who rather pressed for the inclusion of a lower class than G (0·02 foot-candle). There were many residential side streets which were well lighted for their purpose, and which were nevertheless below Class G. Such streets were not as a rule used for fast traffic; and with the specifying of a maximum space of 150 ft., with the light source 13 ft. high, the illumination from a 250 C.P. lamp was adequate for the purpose. It was obvious that in the case of such streets very few local authorities could go to the expense of bringing the illumination up to Class G—especially when one remembered that the greatest space

ratio lamps, to comply with the test conditions, would have to be of 340 to 350 C.P. There were many streets of this character which were quite sufficiently lighted with lamps of a lower power than that. The second point was the question of horizontal illumination. In connection with the 1913 specification, he happened to be one of the most pronounced antagonists of this method. His views had not altogether changed; but he had accepted the horizontal basis for this specification, because he realized that for general purposes and comparisons it was probably as good a method as any other. But there was this point: The specification involved not merely higher light sources, but also closer spacing; and a test when lamps were close together must become more accurate than when they were spaced wider apart. As to the difficulty of lighting some of the wide streets that were encountered in connection with some of the town-planning schemes, with carriage-way grass verge, and footpath outside, it had been suggested that the footpath would get very little light. Well, in schemes where local authorities had been somewhat extravagant in their street widths, might it not be urged that a special method of lighting was called for? Staggered lighting would not do; and it was up to the authority to light each side separately.

Mr. WALDRAM, in the course of a brief reply, said the test in Appendix A, and the figures in Schedule I. appertained to glare, and nothing else. There was nothing in the paper against the use of directive equipment. Such equipment was very important; but there was a difficulty in maintaining it properly focussed.

MEETING OF THE BRITISH ASSOCIATION.

FURTHER MATTERS DISCUSSED AT THE LEEDS MEETING.

[See also issues of the "JOURNAL" for Sept. 7 and 14.]

THE IDEAL EFFICIENCY OF INTERNAL-COMBUSTION ENGINES.

By Prof. W. T. DAVID.

Two suggestions are put forward in this paper—the first, that the ideal efficiencies of internal combustion engines calculated upon the basis of the generally accepted specific heat and dissociation data are too low; and the second, that the ideal efficiencies increase with compression ratio at a rate not only greater than that indicated by the air standard, but also greater than that indicated by ideal efficiency calculations based upon the usual specific heat data.

IDEAL EFFICIENCIES AND SPECIFIC HEATS.

In calculating the ideal possible efficiencies of internal combustion engines, it is customary, in my view rightly, to assume complete combustion of the charge during explosion (it will be convenient to confine the attention to the constant-volume cycle), and to disregard heat loss, but to take into account the variation with temperature of the true specific heats of the constituents of the burnt charge and dissociation (if any) due to temperature. The view here put forward is that the true specific heat and dissociation values usually employed are too high, and that, consequently, the ideal efficiencies calculated by means of them are too low. In other words, the ideal possible efficiencies approach rather more closely to the air standard than is generally supposed. How much more closely, it is not possible to say at present; but it may be of interest to give the reasons for this view.

The usually accepted values for specific heats and temperature dissociation are derived from closed-vessel experiments, and are calculated from them on the assumption that chemical equilibrium is attained by the time the maximum pressure is developed. There is, however, a large volume of evidence that this is far from being the case, and that a considerable proportion of the chemical energy of the original mixture has not been converted into thermal energy when the maximum pressure is reached, even when the explosion experiments are made under conditions which cause temperature dissociation to be a negligible factor. If this view is correct, it will be obvious that specific heat values deduced from such experiments, in which no allowance is made for incomplete combustion, are seriously over-estimated. Similarly, dissociation values determined from high-temperature explosions, in which no allowance is made for incomplete combustion, are seriously over-estimated.

It will now be clear that the problem whether ideal efficiencies, calculated upon the basis of usually accepted specific heat and dissociation values, are too low or not depends upon whether or not chemical equilibrium is established at maximum pressure in explosion experiments. It is therefore proposed to review briefly the evidence for this.

Some early experiments of mine, in which simultaneous measurements of pressure and heat loss were made during closed-vessel explosions of mixtures of coal gas and air of various strengths, showed that in weak mixtures the internal energy at the maximum temperatures in the gaseous mixtures after explosions was greater than that remaining in strong mixtures after they had cooled to the maximum temperatures of the weak mixtures.* In view of the fact that the strong mixtures took an appreciable time to cool to these temperatures, it is reasonable to assume that chemical equilibrium in them had been more or less established; and the only explanation of the greater amount of energy in the weak mixtures at their maximum temperature would appear to be that, by the time the maximum temperature was developed, the whole of the chemical energy of the original mixture had not been converted into thermal energy. It cannot be explained in terms of temperature dissociation, because the estimated proportion of uncombined gas (about 10 p.ct.) was independent of the temperature attained during explosion, and, moreover, the temperature attained in some of the explosions was so low that temperature dissociation was negligible.

During the last few years, in conjunction with Messrs. S. G. Richardson, W. Davies, R. A. Smith, and B. H. Thorp, experiments have been made with pure gases (mainly CO and H_2 mixtures) by the aid of optical indicating and flame photography. Space does not permit of my giving an account of these experiments; but it may be said they show that, even in explosions of pure gases, chemical equilibrium is far from being attained at the moment of maximum pressure. In proof of this may be cited the experimental observation that when gaseous mixtures of given calorific value are diluted with a given volume of diatomic diluents (or mixtures of these), the maximum pressures developed on explosion depend very much upon the nature of the diatomic diluents, in spite of the fact that the specific heats of the diatomic diluents are approximately the same; and their volume was such, in some of the experiments, as to keep the explosion temperatures well below that at which temperature dissociation becomes appreciable. Thus, the mixture $2CO + O_2 + nCO$ develops a much higher pressure than the mixture $2CO + O_2 + nO_2$ when exploded at atmospheric temperature and density and containing the same moisture content for all values of n, even after making an allowance for the difference in heat loss in the two mixtures due to different explosion times. A similar phenomenon is found for hydrogen explosions.

It is true that at very high initial densities Prof. Bone's experiments suggest that the reverse is the case—that is, that the mixture $2CO + O_2 + nO_2$ will develop a higher pressure than the mixture $2CO + O_2 + nCO$—but while this is a perplexing phenomenon, the significant point is that these mixtures, of the same calorific value and approximately the same specific heat, develop different maximum pressures on explosion under conditions such that temperature dissociation is negligible. The explanation seems to be that combustion is more complete at maximum pressure in the one case than in the other. A very complete series of investigations has been made by Mr. Smith with moist $CO + O_2 + N_2$ mixtures in varying proportions, initially at atmospheric temperature and density, in a 6-in. spherical vessel. He shows that in the mixtures $2CO + O_2 + xN_2$ (xN_2 being varied so as to investigate the temperature range 1600° to 3000° C.) there is, at the moment of maximum pressure, at least 10 p.ct. of uncombined gas when the temperatures developed are less than about 2000° C., but as the temperatures increase beyond this figure, the proportion of uncombined gas increases. We attribute the uncombined gas below 2000° C. to incomplete combustion, and the greater amount at higher temperatures partly to incomplete combustion and partly to temperature dissociation.

In the flame photography experiments which we have also been making, pressure and luminosity, during and after explosion, are correlated on the same photographic film. If it may be assumed that, at temperatures which may be commanded in the laboratory, luminosity in gases like CO_2, H_2O, CO, H_2, O_2, and N_2 requires chemical activity, or quasi-chemical activity, for its manifestation, then there is no doubt that chemical, or quasi-chemical, activity proceeds for some time after maximum pressure is reached; for luminosity of sufficient intensity to mark a rapid photographic film continues for a considerable time after maximum pressure and luminosity visible to the eye for a good deal longer.

In another type of experiment, we have been able to obtain rather higher maximum pressures in CO-air and CH_4-air mixtures by isolating the mixtures before explosion with infra-red radiation of the type absorbable by the combustible gas.* Owing to the difficulty in obtaining large pieces of diathermanous material for these experiments, we have only been able to introduce very small quantities of radiation. Nevertheless the effect upon maximum pressure is appreciable. We interpret these experiments as indicating that infra-red radiation of the

* "Proc. Roy. Soc.," A, Vol. XCVIII., 1920, pp. 303-18.

* "Proc. Roy. Soc.," A, Vol. CVIII., p. 393.

correct type acts as a kind of catalyst speeding-up combustion, and so developing higher maximum pressures.

It is, perhaps, important to state that, while I have frequently made use of the phrase "incomplete combustion," I do not attempt to offer an explanation in molecular terms as to what is meant by it. In employing the phrase, I merely mean that the chemical energy of the charge has not been completely converted into thermal energy in equilibrium with temperature.

Recent experimental work on internal-combustion engines seems also to show that the actual thermal efficiency attained is greater than that to be expected from calculations of the ideal efficiency based upon specific heat and dissociation values derived from explosion experiments. Thus, Mr. H. T. Tizard states that Mr. Ricardo has found an efficiency of 33 p.ct. for an engine running under such conditions that his calculated ideal efficiency was only 36 p.ct.* In view of the known losses in the engine, the actual efficiency realized is altogether too high a proportion of that calculated. I have been unable to find the exact figure given by Tizard in any of Ricardo's published work; but in his book on "Engines of High Output" he gives experimental results which support this view, and which lead him to suggest that the specific-heat values upon which the ideal efficiencies are calculated are too high.

THE VARIATION OF THE IDEAL EFFICIENCY WITH COMPRESSION RATIO.

When mixtures of the same composition are exploded in a closed vessel at various initial densities but at the same initial temperature, it is found that the ratio of the maximum pressure developed to the initial pressure (and therefore the maximum temperature developed) increases as the initial pressure increases. I have elsewhere† given reasons for believing that this is mainly due to two causes: (1) That as the density increases combustion becomes more complete at maximum pressure; and (2) that the specific heats of the products of combustion (CO_2 and H_2O) at high temperatures decrease as the density increases. If the latter assumption is correct (and it has experimental foundation), the ideal efficiency will clearly increase with compression ratio at a greater rate than that calculated on the basis of specific heats which are independent of the density.

Support for this view is to be found in some experiments by Messrs. Tizard and Pye. They show that the actual thermal efficiency of an engine increases with compression ratio more rapidly than is indicated by their efficiency calculations. Thus, with a compression ratio of 4, they find the ratio of the actual to their calculated efficiency to be 0·82; whereas with a compression ratio of 7, they find this ratio to be 0·85.‡ When it is realized that, on account of rather higher explosion temperatures and greater ratio of surface to volume, the proportional heat loss is greater at the higher compression ratios, the rate of increase of the actual efficiency with compression ratio is unexpectedly high; and it is not suggested that the decrease in the specific heats with density is sufficient to explain it. It is thought that the other factor mentioned above—viz., more complete combustion during explosion—must also be operative. Temperature dissociation might, at first sight, be thought to have some significance in connection with these results; but this would operate slightly in the other direction, for the decrease in dissociation due to higher pressure at the higher compression ratio is probably more than offset by the increase due to the rather higher explosion temperatures.

Discussion.

Prof. F. C. LEA thought Prof. David was rather bold in putting forward some of his definite conclusions as the result of his experiments, though at the same time he congratulated him on these experiments. Though certain deductions had been drawn from certain curves, the actual points were not plotted to enable one to see exactly how far the maximum and minimum points for any particular set of curves differed from the actual curve drawn. This would at any rate have enabled them to form a more definite opinion as to the final reasonableness of the author's deductions. On the general question of the consideration of efficiencies of internal combustion engines, Prof. Lea asked whether, in comparing the actual indicator cards with what they called the standard cycles, they were really adopting the right basis of comparison. To get at relative efficiencies in the case of a gas engine, they compared them with the standard air cycle. In that case, combustion took place suddenly, and a certain air ratio was obtained. In the case of the Diesel engine another cycle was taken. What was wanted was a cycle of reference by which all types of internal combustion engines could be compared. From the work described in the paper, it was obvious that combustion was taking place in the gas engine for some time after the first explosion, and possibly this was taking place in the Diesel and other heavy oil engines. Therefore, he asked the author whether from his work he would suggest that they should still retain the ordinary air cycle as a standard reference for gas engines, or whether they could now reconsider the whole problem, and adopt some standard cycle of reference which would do for all types of internal combustion engines.

The PRESIDENT said the paper seemed to call for one or two definitions. The first was: When was burning complete? He took it that burning was complete when thermo-chemical equilibrium was established. Unless some such definition was adopted, some arbitrary datum of temperature must be established, and then they were in a maze as regards ideal conditions. As a matter of history, he said that the study of the thermo-chemical equilibrium in explosions of the type discussed in the paper was first carried out in some practical work of his own on high explosives. It was Planck's quantum theory which enabled the thermo-chemical equilibrium conditions to be calculated. Nernst and his colleagues worked out the theory; and when Einstein proposed his equations for the specific heat of gases as a function of temperature based upon the quantum theory, it was an equation for which he personally had been looking for years in connection with his work on explosives. He immediately applied it to the explosion of cordite. Comparing the results of his calculations with the experimental maximum pressures recorded by Nobel, there was marked agreement which convinced him of the correctness of the Einstein equation. At least, it was sufficiently good to encourage him to go on further. During the war the whole ideal diagram for the gun was calculated. The temperatures in the gun were much higher than those in the gas engine; but there had been no experimental evidence to show from the ideal diagram as calculated—which gave a very good approximation of the velocity actually obtained from the gun—that there was any marked delay in the establishment of thermo-chemical equilibrium—in other words, that there was any delay in the burning. If the same calculations were applied to the internal combustion engine, they were met with the fact that the temperatures were much lower. In the gun, the temperatures varied from 3500° down to 2000° Fahr., or a little below, whereas in the internal combustion engine the temperature was from 2500° downwards to a few hundred degrees. This change in conditions made it all the more difficult to say when burning was complete, because undoubtedly there was some delay in burning, due to the walls themselves. There was a layer of cold gas in contact with the walls; and this must affect the indicator diagram. It also affected the flame in the gas; and Prof. David's diagrams must be read with this in mind—viz., that there was a possibility of that layer of cold gas in contact with the walls burning after thermo-chemical equilibrium had been established in the centre of the gas, and masking what was happening inside the body of the gas. From this point of view, the flame was not a good indicator; but it was difficult to see where one could get a better. Prof. David's experiments were one thing, and his theory was another. The experiments might stand; but he was rather doubtful about the theory, and he would like to know what was meant when the author spoke of burning being complete. Was it the calculated heat value after the gases had been cooled down to atmospheric temperature, or were the author's heats calculated on the basis of thermo-chemical equilibrium based on the Einstein equations regarding specific heats and the dissociation equations of Nernst?

Prof. W. CRAMP remarked that Burstall, at Birmingham, had carried out a number of experiments on gases containing CO and oxygen, and had traced a definite time delay in the burning of the gas from the centre outwards. He believed he was right in saying that the time taken for the burning of the gas from the centre outwards was of the same order as the time to the rise to maximum pressure in the author's experiments. In other words, the Birmingham experiments of Burstall showed distinctly that, apart from the layer of cold gas near the walls, combustion was taking place comparatively slowly through the mixture; and this would modify the theory that had been put forward.

Prof. DAVID, in his reply to the discussion, pointed out that, though Prof. Lea had charged him with being bold in putting forward his conclusions, Ricardo, who was an exceedingly careful investigator, had actually measured a thermal efficiency of 33 p.ct. for an engine for which the calculated ideal was 36 p.ct. Tizard had also worked on these lines; and both Ricardo and Tizard would agree that, in view of the known losses of heat in this particular engine, the proportion of the ideal realized, according to present-day calculations, was altogether too high. In view of this, he could hardly be called bold in what he had deduced from his own experiments. As to the experimental accuracy of his own work, it was carried out under conditions of what he believed to be extraordinary accuracy. The pressure experiments were made on photographic films having very thin lines indeed; and three, four, and sometimes five records were made under the same conditions. No experiment was accepted unless every one of these records could be superimposed to such an extent that one could not be seen from the other. But Prof. Lea had raised a somewhat wider point when he spoke of ideal indicator diagrams. Personally, however, he thought he had shown enough by his experiments to indicate that they could not do better than stick to the air standard for the moment. What this particular air standard should be, however, was a rather difficult matter. The Institution of Civil Engineers had suggested a change from the Otto cycle, which was a desirable one except from the point of view of the unfortunate students who had to work out these complicated problems. He had rather expected the question from the President as to when burning was complete. The paper had been written by him as a mere engineer; and what he meant by burning—*i.e.*, combustion—was the over-all process of conversion of chemical energy into the products of combustion—into CO_2 in its normal form—and not in the activated form or anything of that kind. He did not attempt to offer a picture in molecular terms as to what had happened. Dissociation did not enter very much into these experiments, because most of them were conducted at temperatures below 2000° Fahr., so that it was unnecessary to make use of the rather laborious method of calculation which would be required when taking dissociation into account. The President had also suggested that flame was not a good indicator for following the combustion processes in the explosion vessel, on account of the fact that there was a surface layer which was constantly burning. He did not appreciate that difficulty himself, though he would have done so had he been working under the enormous densities employed by the President. In reply to Prof. Cramp, the author said he did not deal with the Birmingham experiments owing to lack of time; but they further supported the views he himself had put forward.

* "Trans. Far. Soc.," No. 69, Vol. XXII., p. 352.

† "Phil. Mag.," February, 1926, p. 335.

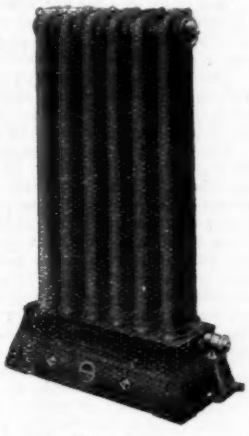
‡ Empire Motor Fuels Committee Report, p. 14.

"REGULO" CONTROLLED RADIATORS.

A new series of "Regulo" controlled gas radiators has been introduced by Messrs. John Wright & Co., to meet the varying needs of all classes of public buildings. The special requirements of shops, offices, cinemas, entrance halls, &c., have also received consideration in the design of these new appliances. In the past, under certain conditions, the heating of factories by means of gas radiators which had not been designed to take flue piping has created difficulties. The special requirements of this class of building can now be met with these new radiators, which work equally well with or without flue piping attached; and by their aid the conditions necessary to satisfy the Factory Acts can be attained.

For use in situations which do not demand the removal of the products of combustion, these radiators also represent a real advance in design. They require no attention, the combustion is perfect, and no water is needed. Further, the automatic control ensures economy in use.

The "St. David" ("Regulo"-controlled).



The "St. Martin" ("Regulo"-controlled).

The "St. David," "St. Vincent," and "St. Martin" are fitted with the "Regulo" gas controller, by means of which the radiator is maintained automatically at a predetermined temperature. If, as a result of a fall in temperature outside, the building tends to cool, then the automatic control on the radiator is brought into operation, and there results an increase in the gas supply which checks the fall in temperature which would otherwise occur; while if the temperature in the building starts to rise, the gas consumption of the radiator is automatically cut down. The "Regulo" is permanently adjusted before leaving the works; and the claim can properly be made that an installation of these radiators needs the minimum of attention while in use.

Particular mention may be made of the "St. Vincent" and the "St. Martin" radiators. The former is fitted with luminous burners and a series of coloured glass windows, which result in a warm, pleasing effect when the radiator is in use. The "St. Martin" radiator has been approved by the London County Council for the warming of public buildings, and particularly theatres and cinemas. The burner is totally enclosed, a special lighting opening being provided. After the burner is lighted, this opening is automatically sealed by a cover plate. Coloured glass in the base of the radiator enables the working of the burner to be observed.

The "St. Bernard" luminous radiator is provided with a specially shaped copper reflector; and the cheerful appearance which results from the use of these radiators makes them eminently suitable for the warming of waiting rooms, entrance halls, shops, libraries, and other public places where a warm and comfortable appearance is so desired. In the "St. Bernard" radiator, the gas pressure is controlled by a governor. The radiators are supplied in black, mahogany, and old gold as standard finishes.

Such radiators are used generally throughout the whole of the working day during the winter months; and this new series would appear to provide gas undertakings with an important additional source of revenue.

The gas-heated radiator possesses obvious advantages over any central heating system. When solid fuel is used, the furnace or boiler has to be heated some hours before the building is required, and has generally to be kept alight night and day during the winter months, whereas with the gas radiator it is only necessary to light the appliances in the various parts of the building a short time before business starts. The control of the temperature throughout the building is also, of course, more readily effected when individual heating units are used in the various rooms.

The elasticity of gas-heated radiators makes an appeal to those responsible for the heating of places of worship and public halls, while the saving in cost of installation is considerable.

OTTO DEMONSTRATION PLANT AT DAHLHAUSEN.

Visited by the Coke Oven Managers' Association on Sept. 4.

On Sept. 4, during their Continental tour, the Coke Oven Managers' Association visited the works of Dr. C. Otto & Co., at Dahlhausen. Prior to the inspection, Dr. Otto explained that the Dahlhausen demonstration plant dates from 1895, and since that date it has been altered and rebuilt from time to time, having served for demonstrating the practical working of the various novelties and improvements which the Otto firm have introduced in the methods of coking and the recovery of bye-products.

In 1925 a battery of five regenerative ovens of a new "twin-flue" system and of the compound type was erected, and this was put to work in June, 1926.

The oven chambers have the following dimensions: Length between buckstays, 33 ft.; height, 14 ft.; medium width, 14 in. The application of the "twin-flue" system to the compound type of oven was made possible through an arrangement of three regenerators underneath each oven chamber. Of these three regenerator chambers, the middle one serves for the preheating of gas, while the two outside ovens serve for the preheating of air. In this way the current of gas, rising through the middle regenerator into the heating wall, is on both sides surrounded by currents of air; and as both currents of gas and air rise under equal suction, no leakage between gas and air is possible, and leakage from gas to waste heat can in no case take place.

When the new ovens were put to work, it was proved that the advantages of the twin-flue system could equally well be made use of for the compound type of ovens as for the ovens heated by their own gas. It was more particularly proved that heating either with rich gas or with poor gas requires no regulation by sliding bricks in the individual flues; so that for changing from rich gas to poor gas, or *vice versa*, it is only necessary to shut off one gas main and to connect the other—an operation which requires practically no time. The heating of the ovens, after the changing from one gas to the other, remains even. This changing of the heating of a compound oven from one gas to another, which used to require a good many precautions and a minute regulation of the individual heating flues, is now the simplest possible operation. The working of the ovens, whether heated with rich gas or with poor gas, is now so much simplified that it is not necessary to check the temperatures continuously by so-called "heaters," as is the custom in the United States.

The working of the new ovens has proved their great simplicity, continued Dr. Otto. The many experts who have visited the demonstration plant have confirmed that the construction of the new ovens simplifies the working, because it is unnecessary to change any nozzles for the rich gas, or to keep constant control of the top temperatures in the heating flues. Though a continuous control is superfluous, all the heating ports have been made accessible to a remarkable degree. Individual heating flues are accessible equally from the top as from the free space underneath the ovens.

The new "Otto" ovens at Dahlhausen have proved that it is not only possible to exceed the height of 4 metres (about 13 ft.), but that the heating of the chambers in vertical direction is considerably improved.

The length of approximately 32 ft. 10 in. could not be exceeded at Dahlhausen with the available space; but as the lengthening of the oven chambers has heretofore offered no difficulties, further special experience in that direction was considered superfluous.

The main object of erecting and working the demonstration plant at Dahlhausen is that it may be used for constantly making tests of coals of different qualities, to compare the results of different coking times, and also to settle the question of the best width of ovens, &c.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Gasholder Capacities.

SIR,—In a recent number of the "JOURNAL," it was stated that there is a gasholder in Manchester of 14 million c.ft. capacity. I believe I am right in saying that the largest in Manchester is only 10 million c.ft.

The largest in England is at the South Metropolitan Gas-Works, East Greenwich, and is of 12 million c.ft. capacity. The largest in the British Empire is at Sydney, Australia, which is slightly in excess of the above.

The "Daily Mail," in commenting on the recent explosion at Manchester, fell into an error by stating that the Manchester gasholder of 10 million c.ft. was the largest in the world, whereas the largest in the world is in New York, and is of a capacity of fully 14 million c.ft.

When is England going to cap this, and recover the lead by erecting a 20 million c.ft. holder?

F. S. CRIPPS.

"Melrose," Hurst Road, Horsham, Sept. 9, 1927.

REGISTER OF PATENTS.

Gas Scrubbers.—No. 263,794.

DUCHEMIN, A. C. D., of Paris.

No. 32,223; Dec. 20, 1926. Convention date, Dec. 31, 1925.

This invention relates to the combination in a horizontal stationary gas scrubber of partitions forming chambers containing filling material, such as Raschig rings, and leaving passage to the gas in a horizontal direction; empty expanding spaces between the successive chambers; means for pumping the scrubbing liquid from the bottom of each chamber to a suitable spraying device at the top; and weirs of different heights for circulating the scrubbing liquid through the lower part of the apparatus in the opposite direction to that of the gas flow.

To arrest the liquids which might be drawn over in the vesicular state, chambers unprovided with liquid may be disposed in the path of the gas or at the end of the apparatus. Several successive scrubbing operations may be performed with different liquids. The partition walls of the chambers may be vertical or inclined to a greater or less degree, in order to take account of the fact that the liquid is drawn forward by the gas in each chamber. The apparatus may consist of cast or sheet iron or other metal, or of any suitable material, such as masonry work, ferro-concrete, or the like, which is unaffected by the gases or scrubbing liquids.

Gas Meters.—No. 264,153.

KRAUER, A. M., ELSTER, J., HAAS-GORZ, L., WEICHELT, E., and HAAS, P., all of Germany, trading as

GASMESSERFABRIK MAINZ ELSTER & Co., of Mainz.

No. 163; Jan. 3, 1927. Convention date, Jan. 7, 1926.

This invention concerns means for controlling the flow of the gas in dry meters having two or more chambers, without entailing losses of pressure; slide-valves of the **D** type and closed conduits between the valves and the outlet and/or inlet pipe being entirely obviated. This is achieved by the provision in each of the measuring chambers of the meter of two ports adapted to be opened and closed alternately by a valve device or valve devices so actuated that, of the pair or of each pair of chambers, one chamber only is at a time in communication with the gas inlet, and the other with the gas outlet.

A chamber containing the gear actuating the valve devices is divided into two parts, with each of which one port of each measuring chamber communicates. Pairs of neighbouring ports not communicating with the same chamber may then be controlled by a common valve device which periodically releases the one or other opening. The valve devices may be plates adapted to oscillate above the pairs of ports, which are best arranged as near as possible to the inlet and outlet pipes respectively.

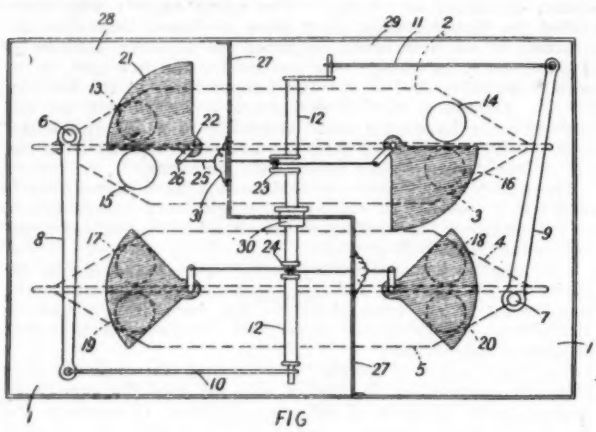


FIG 1.

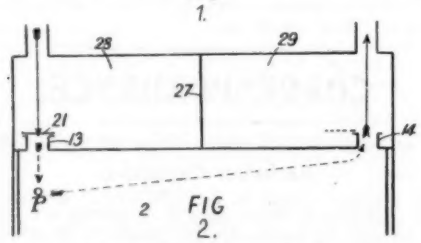


FIG 2.

A Meter with Low Pressure Absorption.

Fig. 1 is a plan view showing the ports and valve-gear of a meter according to this invention; and fig. 2 is a sectional elevation.

The measuring chambers are disposed below the partition 1, and comprise four chambers 2, 3, 4, and 5, the diaphragms of which (not illustrated) transmit their movements to oscillatory levers 8 and 9 by way of vertical spindles 6 and 7. The said two levers are connected positively with one another by connecting rods 10 and 11, and a crankshaft 12. To this extent the device corresponds to hitherto known gas meters.

Each measuring chamber is provided with two connections to the chamber containing the control gear; the chamber 2 having two short pipes 13 and 14, the chamber 3 pipes 15 and 16, the chamber 4 pipes 17 and 18, and the chamber 5 pipes 19 and 20. Each pair of neighbouring pipes or ports—*e.g.*, 13 and 15—is regulated by an oscillatory plate, for example, 21, according to its position in its oscillatory movement, closes either the port 13 only (as illustrated), or both the ports 13 and 15, or the port 15 only. These valves thus have no enclosed space whereby alternate communication with the one or other pipe is effected. Their action is merely that of simple opening and closing.

The oscillatory valves are actuated from the crankshaft 12, which is thus at the same time the control shaft. It has two cranks 23 and 24 which are displaced from one another angularly by 90°. A connecting rod 25 co-operates with the crank 23 and is pivotted at the other end on an oscillatory lever 26 which is secured to a vertical spindle 22 on which the valve plate 21 is mounted. The three other oscillatory valves are actuated exactly similarly from the control shaft in such a manner that, at any time, only the diagonally opposite ports are open together—for example, 14 and 15—but never the two ports of one chamber—for example, 13 and 14. In the position of reversal, all four ports of one pair of chambers are closed for a moment. The oscillatory valves for the ports 17, 18, 19, and 20 are illustrated in fig. 1 as occupying this precise position.

The space above the partition 1 is divided, by a partition 27, into two chambers 28 and 29, one of which, 28, may be connected directly with the inlet pipe, and the other, 29, directly with the outlet pipe; these pipes being secured in the covers of the chambers.

The gas flowing in through the inlet chamber 28 passes, therefore, through the port 15 (fig. 1) into the chamber 3, forces the corresponding diaphragm into the chamber 2, and so drives the gas contained thereln towards the port 14 and through the same into the outlet chamber 29. The control shaft 12 is actuated at the same time from the diaphragm by way of the gear 6, 8, and 10, and moves the valve plates from the position illustrated into the opposite position, in which the ports 15 and 14 are closed and the ports 13 and 16 released. The gas then flows in the reverse direction through the port 13 into the chamber 2, and forces the gas contained in the chamber 3 out through 16 into the outlet chamber 29, and so to the outlet pipe.

The control mechanism intersects the partition 27 at three points; the control shaft 12 and two connecting rods passing therethrough. The control shaft is packed by means of a stuffing box 30, while bag-like leather diaphragms 31, which provide the necessary freedom of movement in orifices in the partition and are nevertheless gas-tight, perform a like function for the connecting rods (*e.g.*, 25).

The path of flow of the gas in the meter, state the patentees, is materially shorter than that of known meters of the type. This is an important feature, because shortening the path of the gas results in a reduction of the velocity, for any particular loading, of the gas particles; the resistance falling in turn with the reduced velocity. No reduction can be made in the length of the path inside the measuring chambers, for it is essential that these should be filled and emptied. The path outside the chambers is, however, considerably shortened.

Gas Heated Grilling Machines.—No. 275,340.

SLACK, J. W., and THE RICHMOND GAS STOVE AND METER CO., LTD., both of Warrington.

No. 11,909; May 7, 1926.

This invention has reference to continuous grilling machines—namely, apparatus wherein the articles of food to be cooked are introduced at one end, conveyed through it by a horizontal continuously moving conveyor, and delivered at the other mechanically, and in their passage through the oven or apparatus are grilled by radiant heat.

According to the invention the articles to be grilled are conveyed through the oven by a conveyor consisting of two sets of parallel endless wires, chains, or the like, by and between which the articles are carried, and which can be adjusted.

The oven comprises side walls and roof, and in some cases a floor, of refractory material; and, in one arrangement, within this longitudinal chamber there are vertically disposed grilling devices on each side, into which flame jets are injected from vertical burners, so that the grillers are rendered incandescent. In the preferred form these griller elements are double, consisting of inner and outer walls; and into the spaces between them the jets of flame are directed, and each burner heats two of the grillers, one on each side in the longitudinal direction.

Between the griller elements two sets of conveyor bands are disposed, and move continuously in the same direction; and between these the articles of food are introduced. The conveyor may consist of two or more wires, cords, chains, or bands at each side of the centre of the machines, and these pass over grooved pulleys mounted on vertical axes, one on each side of the central axis, at each end of the machine. Round these pulleys at each end, in some cases, enamelled metal shields will be provided, which curve inwards round them; and their curved-in ends come near one another, and through the opening between same the food is introduced.

The conveyors are adapted to grip and convey articles of different thicknesses or sizes by spring-retained rollers or the like, which cause the two parallel conveyor members to be pressed towards one another at different points, with a yielding pressure. Some of these spring-pressed means are provided at each end, and some at intervals in the interior of the oven, and they may be in slipper or roller form. Furthermore, throughout their travel through the oven, one of the sets of conveyor pulleys is pressed by a spring or weight in a longitudinal direction, so that the bands are always kept taut.

The gas is supplied to the various burners on each side by a

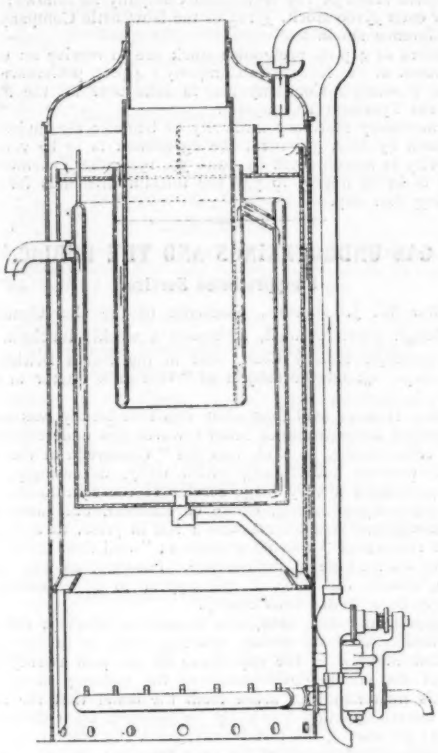
longitudinal supply pipe, from which lead transverse tubes to the vertical burners; and the burners have air regulating discs and gas needle adjusters.

A Closed Geyser.—No. 275,837.

STILES, H., and the ALDERSHOT GAS, WATER, AND DISTRICT LIGHTING COMPANY, both of Farnborough.

No. 29,022; Nov. 17, 1926.

This invention consists in a heater wherein, when the water and gas are simultaneously turned on and the burner lit, the water flows up a water pipe arranged exteriorly of the apparatus and feeds into a filler cap. From the filler cap the water falls into the deeper compartment of a compartmental tray, till it fills the same and overflows down into a water space between the shells of the outer vessel, and gradually rises therein until it overflows the outer wall of the compartment of lesser depth of the tray, till it fills this and overflows the inner wall. The water then flows down the water space between a centrally disposed depending tube and the flue tube of the apparatus till it rises and reaches an inclined pipe connecting the water space with the top of the heater proper. Here it enters the water space between the double walls and the double bottom of the heater, and gradually rises therein till it reaches and flows out by way of a draw-off pipe. The heat from the burner is deflected by the heater proper to rise up in the space between the inner wall of the outer shell and the outer wall of the heater to the top of the heater, and is then deflected down into the space between the inner wall of the heater and the depending tube to the bottom. The gases then enter the open lower end of the flue tube.



A New Closed Geyser.

When gas and water supply are cut-off, the water in the deeper compartment of the compartmental tray ceases to overflow, while the water in the spaces of the depending tube and the heater is, by the heat pressure set up, caused to flow and empty out of the heater by way of the draw-off pipe. The condensation water in the interior of the heater flows by way of a condensation pipe to a collecting trough, from which it subsequently passes.

The accompanying vertical section makes the arrangement clear.

An Easily-Cleaned Gas Lamp.—No. 275,766.

FOSTER & PULLEN, LTD., and GILL, A., both of Bradford.

No. 16,610; July 2, 1926.

The idea of this invention is to provide an overhead suspended lantern easy of access for cleaning and renewals. The patentees observe that in the lanterns of the kind referred to, considerable difficulty is usually experienced in gaining access to the interior for cleaning or renewal purposes, and it is generally necessary to take the parts apart, though in some forms of lantern the dome or cover portion has been hinged to facilitate access to the interior. In this invention the ventilating, central, and shade parts may be separable one from the other without of necessity entailing complete detachment. The lantern is carried from brackets of a suitable support, these brackets forming the gas-way to the burner and by-pass. The central portion is hinged to the shade portion on one side, and provided with clamping securing means on the other. To the central portion is hinged by suitable means the upper or ventilating portion, which parts are provided with clamping or locking devices all readily separable. The hinges preferred are of such a type that the parts may be moved apart; and at one point in the opening or closing position one hinged portion may be moved free of the other, thus permitting the parts to be separated. This construction enables access to be easily obtained to the interior of the lantern without actually detaching any of the parts, though such parts are detachable if desired.

The invention is described and illustrated in great detail in the specification.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Sept. 14.]

Nos. 23,204—23,882.

HARRIS, H. E.—"Gas and oil fires." No. 23,646.
MASTERS, E.—"Regenerator gas retort settings." No. 23,747.
MASTERS, J. E.—See Masters, E. No. 23,747.
STAUBER, G.—"Gas turbines." No. 23,874.

TRADE NOTES.

Gas Lighting, Heating, and Cooking Appliances.

A new catalogue has been published by Lighting Trades, Ltd. (incorporating J. & W. B. Smith, Ltd.), which will be of great interest to the gas industry. The method in which the various appliances and fittings are illustrated and described deserves much praise. Perusal of the new list reveals the widespread activities of Messrs. Lighting Trades.

Hans Renold Chains.

In the revised edition of the standard stock drive booklet issued by Messrs. Hans Renold, Ltd., Burnage Works, Didsbury, attention is drawn to the extended range of these drives up to 100 H.P., and to the increased pinion speeds and adaptability of the drives to different H.P. ranges at varying speeds. Since the introduction of Renold standard drives eighteen months ago, 5000 have been supplied direct from stock to customers.

Woodall-Duckham Verticals for Kidderminster.

The Kidderminster Gas Company, on the recommendation of their Engineer and Manager, Mr. Percy Dougall, have placed an order with the Woodall-Duckham Vertical Retort and Oven Construction Company (1920), Ltd., for an installation of continuously working vertical retorts. This will consist of ten 62-in. retorts, capable of carbonizing 56 tons of coal per 24 hours. The setting will be arranged in a steel-framed, brick-panelled retort house, and is to be complete with coal handling plant, coke screening and storage plant, and waste-heat boiler.

A Catalogue de Luxe.

A new gas grate booklet issued by the Davis Gas Stove Company, Ltd., of 60 and 62, Oxford Street, W. 1, is veritably a catalogue de luxe. The illustrations are outstanding in their quality and effectiveness. It is a case of excellent gas fires being worthily pictured. The photographic illustrations include Davis gas grates installed in the Library of the Medical Society of London, and in the Museum of Hygiene of the Institute of Hygiene. The booklet also contains brief illustrated descriptions of the "Nautilus" gas flue and the new patent ventilating flue block, which is intended to ensure supplementary ventilation near the top of the room. It is applicable to the "Nautilus" system of flue construction. The ventilator consists of a special flue block, into which a cast-iron frame and a ventilating grating are fitted. The former divides the chimney shaft into two compartments; the front section communicating, by means of the grating, directly with the room immediately below the ceiling level, the rear section communicating with the lower portion of the chimney. Provision is made to enable the grating to be removed easily for cleaning whenever required.

CONTRACTS OPEN.

Boiler.

The Teignmouth Gas Department are inviting tenders for the supply of a Lancashire boiler. [See advert. on p. 708.]

Condenser and Washer Scrubber.

The Teignmouth Gas Department are inviting tenders for the above. [See advert. on p. 708.]

Gasholder.

Tenders for the supply of a gasholder are invited by the Teignmouth Gas Department. [See advert. on p. 708.]

Pipes.

Tenders for cast-iron pipes are invited by the Teignmouth Gas Department. [See advert. on p. 708.]

Station Meter.

Tenders for the supply of a station meter are invited by the Teignmouth Gas Department. [See advert. on p. 708.]

MISCELLANEOUS NEWS.

SHEFFIELD GAS CHEAPER.

Less than Before the Coal Strike.

The Directors of the Sheffield Gas Company have announced that from the readings of the meter indices for the September quarter's accounts, the price of gas will be reduced by ½d. per therm, or 1d. per 1000 c.ft. The prices will then be as follows:

For gas supplied in quantities up to 500 therms (100,000 c.ft.), 6½d. per therm, equal to 2s. 10d. per 1000 c.ft.;

For the excess beyond 500 therms (100,000 c.ft.) up to 2500 therms (500,000 c.ft.), 5⅝d. per therm, equal to 2s. 2d. per 1000 c.ft.;

For the excess beyond 2500 therms (500,000 c.ft.) up to 15,000 therms (3,000,000 c.ft.), 5d. per therm, equal to 2s. 1d. per 1000 c.ft.;

For the excess beyond 15,000 therms (3,000,000 c.ft.) up to 30,000 therms (6,000,000 c.ft.), 4⅜d. per therm, equal to 2s. per 1000 c.ft.;

For the excess beyond 30,000 therms (6,000,000 c.ft.), 3d. per therm, equal to 1s. 3d. per 1000 c.ft.;

For all gas consumed in any one year on one and the same premises.

SCIENTIFIC SALESMANSHIP.

Its Place in Commerce.

Speaking on Sept. 15 at the annual meeting of the Incorporated Sales Managers' Association of the United Kingdom, which followed a dinner given at the Connaught Rooms, Mr. F. W. GOODENOUGH, Sales Controller of the Gas Light and Coke Company, the Chairman, said that, large as was the membership of the Association in London and in Manchester and Bristol, it had to be more widely spread throughout the country if they were to be truly a national body. They had a great work to do, because it was becoming more and more recognized that the development of scientific salesmanship was the most important problem that commerce had to face at the present day. Industry had developed production on scientific lines to a very large degree; but it was no use industry producing scientifically unless commerce sold scientifically and placed the production of the factories to the greatest advantage throughout the world.

Mr. J. M. BEABLE, the Retiring President of the Association, who is succeeded in office by Viscount Burnham, said that appreciation of a customer's wants, and the most economic way of supplying those wants, constituted the test of true salesmanship.

Mr. GOODENOUGH was elected Chairman of the Association for the second year in succession.

METROPOLITAN GAS COMPANY OF MELBOURNE.

Half-Yearly Meeting.

The Half-Yearly Meeting of the Metropolitan Gas Company of Melbourne was held on July 28—Sir JOHN HIGGINS (Deputy-Chairman of Directors) presiding.

The DEPUTY-CHAIRMAN, proposing the adoption of the report and balance-sheet for the half-year ended June 30, referred to Mr. A. E. Bradshaw's completion, on Feb. 1 last, of fifty years' service as an officer of the Company. Mr. Bradshaw, who had won his present high and responsible position by long and meritorious service, joined the Collingwood Gas Company in 1877. On the amalgamation of the Companies in 1878, he became a member of the staff of the present undertaking, occupying various clerical positions until 1888, when he was appointed Cashier. Fifteen years later he became Accountant, and in 1913 received the additional appointment of Assistant Secretary, occupying the dual office until April, 1923, when, on the death of Mr. John Hinde, he was appointed to his present position of Secretary. Suitably to commemorate the occasion of his jubilee, the the Board voted him an honorarium of 500 guineas.

They were again in a position to report an increase in the output of gas. The total quantity sold for the half-year was 2,016,532,000 c.ft., compared with 1,924,109,000 c.ft. for the corresponding half of 1926—an increase of no less than 92,423,000 c.ft., or 4·8 p.ct. The profits for the half-year amounted to £105,520. From this sum a transfer of £10,000 had been made to the reserve fund, leaving, after payment of the dividend of £88,125, a balance of £7395 to be added to the carry-forward. The use of gas for industrial purposes showed a steady rate of increase—a total of 310 industrial appliances being disposed of, as against 297 for the June half of 1926. There had been an increasing demand for large gas-fired copper boilers for various processes of manufacture. They had also supplied more than 70 special high-power burners to manufacturers, to be applied to new apparatus of their own construction, or for the conversion of existing solid fuel appliances to gas. The output of furnaces, drying ovens, steam boilers, and other industrial appliances had been well maintained.

During the half-year, 31 cookery demonstrations were conducted at the Head Office and at suburban centres, while outdoor stove instructresses called on 1725 consumers, giving, where required, helpful advice and practical instruction in the method of obtaining the most satisfactory results from a gas cooker.

New Depôt of the Welsbach Light Company, Ltd.—Yesterday the Company opened a new Scottish Depôt at 123, Fountainbridge, Edinburgh. The telegraphic address is Welsbach, Edinburgh; and the telephone number Edinburgh 22910.

TYNEMOUTH GAS COMPANY.

Terms of the Proposed Amalgamation with the Newcastle-upon-Tyne and Gateshead Gas Company.

A meeting of the stockholders of the Tynemouth Gas Company has been called for next Tuesday, when the terms of the proposed amalgamation of the undertaking with the Newcastle-upon-Tyne and Gateshead Gas Company will be discussed.

Under the scheme the stockholders of the Tynemouth Company are to receive stock of the Newcastle Company as follows:

(*a*) For each £100 stock, £125 of the Newcastle Company's 4 p.ct. preference stock.

(*b*) Holders of 4 p.ct. preference stock are to receive an equivalent amount of the Newcastle Company's 4 p.ct. preference stock.

(*c*) The Newcastle Company are to take over all the mortgages of the Tynemouth Company.

If the necessary statutory authority to transfer the undertaking is not obtained by Dec. 31, 1928, the agreement is to be void; and if the authority is not obtained by June 30, 1928, the Tynemouth Company are to be at liberty to pay the interim dividends for the half-year ending that day.

GAS UNDERTAKINGS AND THE PUBLIC.

Unappreciated Service.

Councillor W. J. HARVEY, Convener of the Gas Committee of the Edinburgh Town Council, addressed a weekly luncheon meeting of the Edinburgh Rotary Club, held in the North British Station Hotel on Sept. 15, on the subject of "Gas as a Factor in National Efficiency."

Councillor HARVEY said that what was true locally was true generally regarding the attitude of mind towards gas undertakings. The local gas undertaking, he said, was the "Cinderella of the Corporation;" it was an undertaking which daily, unceasingly, and unfailingly performed a very large service to the community, and yet did not, generally speaking, excite enthusiasm, but rather suffered from indifference. When there was a fall in price, there was a sort of general remark of "well done cinders;" and then the community lapsed into its attitude of indifference. Possibly, as was happening elsewhere, should the price of gas appear to be excessive locally, there would be a tremendous outcry.

There was a mistaken idea, said Councillor Harvey, that the gas industry had reached its zenith; nothing could be further from the truth, either in view of the experience of the past twenty years or in view of the steady development of the industry at the present time. This mistaken idea arose from the belief that the rapid advance of electricity must inevitably be followed by a decline in the use of gas; yet during the last twenty years the amount of gas used in this country had increased by over 70 p.ct., and at the present time a steady advance was the annual experience of the industry.

AMERICAN GAS INDUSTRY.

If one turned to America, a country more daring in change, but not necessarily more sound in progress, the figures there were graphic and interesting. In 1921 there was invested in America 113 million dollars in electric stock. This rose in 1924 to 176 million dollars, while during the same period the kilowatt hours per head of the population rose from 612 to 845. One might expect that there would at least have been a check in the progress of the gas industry in that country. On the contrary, gas stocks in America had steadily improved in standing on the Stock Exchange and had enormously increased in value. The output of gas in 1921 in America was 326 thousand million c.ft. In 1924 this figure rose to 400 thousand millions, an increase representing 24 p.ct. The conclusion come to in America (and experience in this country confirmed it) was that electrical development was not in conflict with the development of the gas industry, but that in point of fact the progress of the one meant the advancement of the other.

GAS AND LABOUR SAVING.

Apart from efficiency in use of coal, the other factor which had determined the progress of the gas industry had been the desire for labour-saving devices. The average increase in the number of cookers and grillers in this country during the last twenty years was 200,000 per annum. Incidentally, without being aware of it, the public, in their enthusiasm for labour-saving devices in their homes, had contributed largely to the health of the community by the purifying of the air of the country. It was acknowledged that, while fogs still existed, they were less dense that they used to be; and in London alone in fifteen years the sootfall recorded had decreased from 76,000 tons to 40,000 tons annually—a very interesting result of the increased use of gas and coke in the city.

It might be an exaggeration to say, as was stated in some places in America, that gas was still in its infancy; but certain it was the progressive life of the industry was assured for very many years to come, and its services to the nation would continue because they were necessary to the comfort of the individual and to the industrial development of the nation.

Co-Partnership at Watford.—A highly satisfactory state of affairs is disclosed in the report of the Co-Partnership Committee of the Watford Gas and Coke Company for the year ended June 30. The bonus and interest paid by the Company for the year again shows an increase, and amounts to £1235. The Committee purchased £135 "B" additional stock in June last, and this has already been allotted.

INSTITUTION OF GAS ENGINEERS' EDUCATION SCHEME.

Further List of Successes in the 1927 Examinations.

The Organizing Secretary of the Institution of Gas Engineers' Education Scheme (Mr. Walter Hole) has forwarded a further list of successes obtained in the examinations in Gas Engineering and Gas Supply this year. (Previous lists were published in the "JOURNAL" for July 6 and Aug. 24.)

In connection with the results published in the "JOURNAL" for Aug. 24, p. 453, the following have been awarded the coveted "With Distinction;" and this will be recorded on their certificates:

BIRMINGHAM TECHNICAL SCHOOL.

Gas Supply—Ordinary Grade.

Evans, Cyril Thomas.

REGENT STREET POLYTECHNIC.

Gas Engineering—Ordinary Grade.

Rogers, Charles W. M.

MANCHESTER COLLEGE OF TECHNOLOGY.

Gas Engineering—Ordinary Grade.

Clegg, Joseph.

Mr. Frederick Graham, of the Westminster Technical Institute, has been awarded a Second Class Certificate in the Higher Grade in Gas Supply, instead of the Ordinary Grade, as previously published.

The following additional awards have also been made:

BIRMINGHAM MUNICIPAL TECHNICAL SCHOOL.

Gas Engineering—Higher Grade.

Name.	Class.	Ancillary Subjects Taken.
Ward, Denis John	2nd	Applied Mechanics and Heat Engines, Electrical Engineering.

EAST HAM TECHNICAL COLLEGE.

Gas Engineering—Ordinary Grade.

Casseldine, Gerald Edward	1st	Inorganic Chemistry, Organic Chemistry, Gas Engineering Calculations.

BURNLEY MUNICIPAL TECHNICAL COLLEGE.

Gas Engineering—Ordinary Grade.

Harris, Robert W.	2nd	Maths., Inorganic Chemistry, Organic Chemistry, Physics.
Powdrill, John	2nd	Inorganic Chemistry, Organic Chemistry.

HUDDERSFIELD TECHNICAL COLLEGE.

Gas Engineering—Ordinary Grade.

Ward, G. A.	2nd	Organic Chemistry, Physics, Mechanics and Heat Engines.

HALIFAX TECHNICAL COLLEGE.

Gas Engineering—Ordinary Grade.

Waddington, Richard Eric	2nd	Maths., Engineering Science, Engineering Drawing.

WESTMINSTER TECHNICAL INSTITUTE.

Gas Supply—Higher Grade.

Sutherland, Geoffrey W.	2nd	Mechanics and Heat Engines, Building Drawing, Gas Laboratory.

SUBJECTS FOR THESES IN GAS ENGINEERING.

In order to give guidance to those candidates for the Diploma in Gas Engineering who may be in doubt as to choice of subject for their theses, the Examiners have compiled the following list of suggested subjects from which choice may be made.

1. Methods for reducing the loss of make during scurfing, especially in vertical retorts.
2. Improved results to be obtained by incorporating in carburetted water gas plants the modern improvements now available.
3. Coke grading and coke grading plants, coke cleaning and drying, and the possibility of creating a greatly increased demand for graded coke for domestic heating stoves.
4. The valuation of coal for gas-works purposes.
5. The complete recovery of waste heat on gas-works, including exhaust steam.

It is to be clearly understood that the publication of this list (which merely indicates the sort of subject that is suitable) is not intended to fetter in any way the free choice of subject by the candidate. The Committee would prefer that each candidate should choose his own subject, as a result of his own experience. Any such which falls naturally within the wide limits of "some aspect or point of Gas-Works Construction or Gas Manufacture" (Clause 5, p. 22, of the Regulations) will be acceptable. The Committee stipulates only that the thesis shall show original thought, observation, and deduction—not necessarily original research work—and not be simply a summary of information and results which have been altogether taken or can be obtained from text books.

As a further guidance to any who may be in perplexity on the matter, the following list of subjects upon which theses have been already accepted is appended:

LIST OF SUBJECTS UPON WHICH THESES HAVE BEEN ACCEPTED.

1. Reorganizing the Retort House.
2. Purification of Sulphate Effluent.
3. The Centrifugal Separation of Gas-Works Emulsions.
4. The Construction and Working of the Dempster-Toogood System of Vertical Retorts.
5. The Effect of Steaming in Continuous Intermittent Vertical Retorts on the Production of Therms and Ammonia.
6. The Purification of Crude Coal Gas from Ammonia and Ammonium Compounds.
7. Technical Control of Continuous Vertical Retorts.
8. The Manufacture of Sulphate of Ammonia.
9. The Volatile Products of Coal with Continuous Vertical Retorts.
10. The St. Mungo Washer-Scrubber.
11. Coal Gas Condensation.
12. Direct and Indirect Ammonia Recovery in Relation to Gas-Works Practice.
13. The Neutralization of Sulphate of Ammonia.
14. Carbonization: Present and Future.
15. The Drying and Starting of Vertical Retort Installations.
16. The Use of External Producers for Heating Retort Settings.
17. Some Points in the Design and Operation of Horizontal Retort Settings.
18. Methods of Coal Carbonization.
19. Mains on Gas-Works.
20. The Effect on the Gas-Making Value of Gas Oil of its Previous Use for the Removal of Naphthalene from Coal Gas.
21. Notes on Gasholder and Tank Construction.
22. Experiences with the Reconstruction and Modernization of a Vertical Retort Installation.
23. The Purification of Gas-Works Effluent: A New Method.
24. Development of Outside Producers, with Special Work on Thermal Efficiencies of Same.
25. Some Phases of the Dehydration of Gas.
26. Silica Material and its Use in Modern Horizontal Retort Settings.
27. Inerts in Coal and Coal Gas.
28. Naphthalene.

CITY AND GUILDS OF LONDON INSTITUTE EXAMINATIONS.

Report on the Examinations of 1927.

The following is the report on the recent examinations bearing upon gas of the City and Guilds of London Institute. The entries for the different subjects and grades were as follows:

—	Pass.		Fail.	Total.
	1st.	2nd.		
Minor Course in Gas-Works Practice	14	10	10	34
Minor Course in Gas Supply Practice	3	18	20	41
Gasfitting. Grade I.	41		39	80
" Grade II.	16	11	57	84
" Final	22	30	39	91

The report is given on the papers worked throughout the country as a whole.

MINOR COURSE IN GAS-WORKS PRACTICE.

On the whole the papers this year showed a very marked improvement. Sketching is, however, a weak point; and while many of the examinees appear to have a good and practical knowledge of the apparatus which they describe, their sketching greatly detracts from the value of their answer. The examination may, however, be considered satisfactory.

MINOR COURSE IN GAS SUPPLY PRACTICE.

The papers submitted this year showed a marked improvement in clearness of expression as evidence of clearness of thinking. In most cases the matter of the answers was more methodically arranged, though there is still room for improvement in this direction. Many of the sketches were good, but others showed an absence of attention to the forms of objects, such as pipe sockets, which ought to be familiar to the student.

Perhaps it is too much to hope for an absence of mistakes in spelling, since no doubt some are due to hurry to complete the papers in time; but they are still too frequent, and an annoyance to the Examiner.

GAS-FITTING.

The work done by the candidates shows a marked improvement compared with last year, particularly in the Final Grade. The questions set in the Final, Second Written Paper (Science), were particularly well answered, and some of the drawings were excellent. But candidates should again be warned to read the questions through very carefully before answering them, and to confine themselves to

answering their subject-matter. In several instances candidates failed to answer parts of questions, or wasted time dealing with irrelevant matter. In questions dealing with the method of fixing appliances, answers would be improved if the description followed the sequence of operations as they would actually be performed.

From the answers given to Question 5 (Grade I.), it is apparent that in many cases candidates have had no practical experience of the use of a pressure gauge in testing installations for leakage. This fact is to be deplored, and should be remedied.

The lack of method displayed by candidates in the practical tests was commented on by several local examiners. The candidates should be instructed to work to drawings and templates in bending iron and lead piping. Students should receive fuller instruction in the practical aspects of their every-day work, such as the consumption of various appliances and the pressure absorbed in delivering varying quantities of gas through pipes of various diameters and lengths.

In Question 7 (Grade II.) answers for the total consumption of the cooker, all full on, varied from 3¼ c.ft. to 18·5 c.ft. per hour.

Many gas undertakings and teachers call the flow pipe of a hot water installation the return, and *vice versa*. Hence a great amount of confusion in the minds of students. It should be made clear that the hot water leaves a boiler or circulator via the flow, and returns from the tank or cylinder to the bottom of the boiler, via the return.

Improvement in all grades in writing, spelling, and composition was noticeable.

GRADE I.

Question 2.—The third portion of this question was either missed or ignored by a number of candidates. In many answers the pressure gauge was not mentioned in the list of tools or for testing the work. There was some confusion between the "service" and "riser," which would seem to imply a lack of standardization of terms in the industry.

Question 3.—Candidates generally were very weak on the final part of the question.

Question 4.—There was a marked improvement in the reading of indices as compared with last year, though some candidates read the 100 dial as units.

Question 6.—The descriptions of the method of fixing the fire were poor, but the consumptions given were generally correct.

Question 7.—The answers given were rather disappointing, and in many cases the consumptions of the cooker were grotesque.

Question 8.—Candidates gave very mixed answers. The sketches for a burner governor included Sugg's distance control device, a mercury pressure governor, burner adjusters, a superheater, and a Carter's valve.

Question 9.—Answers were very fair.

GRADE II.

Question 1.—Answers generally rather weak, and a number of candidates show by their sketches that they do not understand the principles of the construction of a baffler.

Question 2.—Answers very fair.

Question 3.—Many candidates marked the flow pipe return pipe, and *vice versa*. Several candidates showed how to reduce the quantity of water in circulation to 10 gallons, instead of by 10 gallons.

Questions 4 and 5.—Answers fairly good.

Question 6.—Should receive more attention from teachers.

Question 7.—Answers fair. Some confusion of inset and inclined types of fires.

Question 8.—Several candidates gave sketches of indoor lamps.

Question 9.—Candidates are generally very weak as to the arrangement of the mechanism of the meter, and should receive fuller instruction thereon. They should be taught to sketch sections of meters in plan and elevations, and to describe the cycle of operation. Nearly all candidates failed to answer the last part of the question correctly—viz., that the minimum quantity of gas would be the capacity per revolution of the particular size of meter.

FINAL: FIRST WRITTEN PAPER.

Question 1.—Some candidates lost marks by not answering the third section of the question. The answers on the whole were particularly good. Some sketches also were very good.

Question 2.—Most candidates apparently found this question rather difficult.

Question 3.—Ventilating lamps for lecture halls were mentioned by only one or two; some of the sketches were good.

Question 4.—Time was wasted by some in describing the hot-plate and other parts of the cooker.

Question 5.—Only a few left the expansion pipe in the converted tanks as a vent pipe; very few showed a secondary return from bathroom, though a note was made in the question as an indication that a secondary return was necessary.

Question 6.—Only two or three answered this question.

Question 7.—Most candidates confused distance lighting control with automatic control, and are apparently not conversant with the useful combination of the clock-work controller and Sugg's distance control device.

Question 8.—Answers fairly good.

Question 9.—Candidates should be warned not to accept all advertisements as scientific facts. Many would have done better if, instead of writing an essay on the "injector-ventilator," they had simply stated that a fire should have a flue outlet of ample area, and had then given other constructional features of importance.

FINAL: SECOND WRITTEN PAPER

Question 1.—Some really first-class descriptive drawings were given.

Question 2.—Answers on the whole good.

Question 3.—Candidates did not realize that in a paper including drawing the neatness of the sketches was important.

Question 5.—Drawing very fair; most candidates wrong on **S** bend.

Question 6.—Very fair answers.

Question 7.—Some very good sketches were given.

ST. ANDREWS' NEW GAS PLANT.

Formal Inauguration.

Seventy delegates, drawn from all over Scotland, and representing all the principal gas undertakings, either municipal or private, were present in St. Andrews at the recent inauguration of the new holder, purifiers, and carburetted water gas plant of the St. Andrews Gas Company, Ltd.

The visitors were welcomed by the Chairman of the Company, ex-Provost Aikman, and a formal inspection of the new plant was made. Following this, the visitors were entertained at lunch by the Company at the Imperial Hotel—ex-Provost AIKMAN presiding.

In replying to the toast of the St. Andrews Gas Company, proposed by Treasurer FRASER, Mr. AIKMAN said there was a great future for gas, even with the competition of electricity, and the demand for their product was increasing. With the new plant, however, they had every hope of being able to meet all demands.

COAL TRADE REPORTS.

From Our Own Correspondents.

NORTH-EAST COAST.

There is no improvement in the market, and conditions generally are dull and disheartening. Northumberland steams are at a very low ebb, and in Durham coals there is little trade passing in the coking section, second-class steams are short of trade, and only in the best qualities of gas and bunkers is there anything like the volume of business to keep the pits working. New orders of any kind are only of the hand-to-mouth variety, and customers cannot be induced to buy for any distance ahead. The position, therefore, remains uncertain, and quotations for forward inquiries are generally higher than for prompt.

Northumberland steams quote no higher than 14s. f.o.b. for best screened sorts, and even at this price orders are scarce. Wear Special gas is quoted at 16s. 3d., and best qualities ask 16s. Seconds are 13s. 6d. to 14s. Unscreened coking is in very meagre demand, and obtainable for prompt at 13s. 6d. f.o.b., while 14s. is quoted for forward. Ordinary Durham bunkers are freely offered down to 13s. 6d., and even this price is said to have been discounted by collieries badly in need of trade. Best bunkers are fairly firm at 14s. 3d. to 15s. 3d., according to place of shipment.

Gas coke is in good demand, and 20s. 6d. to 21s. f.o.b. is firmly maintained as shipment price.

YORKSHIRE AND LANCASHIRE.

Gas coals in Yorkshire and Lancashire are moving steadily under contract, and collieries are able to execute all orders promptly.

There are better inquiries from abroad, but so far little tonnage has materialized.

Industrial fuel of all descriptions continues to move slowly, and values are extremely low without encouraging much buying for stocking purposes. Some local areas show a better consumption, but generally speaking the steam coal trade is very dull. The slightly increased demand for household fuel continues; but the volume is not sufficient to have any marked effect, although some collieries are working longer hours. Some of the lower-priced qualities have been advanced, but the majority remain unchanged. No doubt, however, an effort will be made to stabilize quotations towards the end of the month.

The following are the Humber bunker and export prices, f.o.b. usual shipping ports: South Yorkshire—Hards, Association, 16s. 7½d. to 16s. 10½d.; screened gas coal, 16s. 6d.; washed trebles, 16s. 6d. to 17s.; washed doubles, 15s. 9d. to 16s.; washed singles, 15s. 3d. to 15s. 6d.; washed smalls, 11s. 6d.; rough slack, 10s.; smithy peas, 17s. to 18s. per ton. West Yorkshire—Hartley's (f.o.b. Goole), 15s. to 15s. 6d.; screened gas coal, 15s. to 15s. 9d.; washed trebles, 16s. to 16s. 3d.; washed doubles, 15s. to 15s. 6d.; washed singles, 15s. to 15s. 6d.; washed smalls, 10s. 9d. to 11s.; unwashed trebles, 15s. 3d. to 16s.; unwashed doubles, 11s. 9d. to 12s.; coking smalls, 10s. to 10s. 3d. per ton. Derbyshire, Nottinghamshire, and Lancashire—Top hards, 17s. 3d. to 18s. 9d.; washed doubles, 16s. to 16s. 3d.; washed singles, 15s. to 15s. 3d.; washed smalls, 10s. 9d. to 11s.; rough slack, 10s. per ton. Yorkshire, Derbyshire, and Nottinghamshire—Screened steam coal, 15s. to 15s. 3d.; gas coke, 20s. to 20s. 9d.; furnace coke, 18s. 9d. to 19s. 6d. per ton.

MIDLANDS.

The domestic demand continues to increase, though not very markedly. Instances in which prices have been stiffened are few, and affect only special descriptions of high-class coal which were neglected to a great extent when the collieries would have been very glad of orders, and are now wanted in a hurry. Consumers have themselves to thank if they are called upon to pay for their indifference as conditions of supply and demand become more stringent. For the present, however, anything like tension is exceptional.

The continued backwardness of the industrial demand puts collieries in a dilemma. Some of them are compelled to restrict operations on the house coal side on account of the difficulty of clearing slacks and smalls. Accumulations of these have to be got rid of at what they will fetch. Spot lots of 1¼ in. slacks of good average quality have sold at 5s. to 6s. Beans have attracted such little notice that prices round about 8s. have been accepted. Steams continue to sell at 15s. upwards.

Hard cokes are in no better request; the closing-down of blast-furnaces neutralizing the seasonal quickening of demand in other directions. Quotations are round 13s. at the ovens.

Gas Explosion in Tufnell Park Road.—An explosion which caused two persons to be slightly burned occurred in a house in Tufnell Park Road, N., on Sept. 15.

STOCK MARKET REPORT.

As we foreshadowed, there was an increasing tendency last week to take the profits which had accrued during the recent activity in Industrial shares; but the sales thereby engendered had but a slightly retarding effect on prices, which soon recovered and made further progress. There was some scattered liquidation towards the week-end, however, and in some directions the tone was heavy. This was particularly noticeable in the Tobacco section, with, perhaps, the exception of Carreras, which improved on dividend rumours. The Foreign Market was quiet, and quotations were not much altered.

Gilt-edged securities suffered a general decline on the terms of the Conversion Loans offers. Although the response to the first of the Government projects—the 4½ p.ct. Treasury Bonds, 1934—was satisfactory in volume, there was considerable criticism of the price obtained, and when dealings began the new bonds were dealt with in and about $\frac{1}{16}$ discount. Funding Loan, which, by way of an exception, had been in good demand, touching 87$\frac{9}{16}$, dropped back in sympathy; and Victory Bonds were similarly affected.

Some interest was taken by the Coal and Iron section in the good results announced by the Sheepbridge Company, the Staveley Company, and Messrs. Lambert Bros. All three concerns are paying higher dividends; but they have no effect apparently on the market generally.

Gas Stocks were again well supported; the chief feature being a rise of 10½ points in the Tynemouth stocks following on the announcement of the proposed amalgamation with the Newcastle-upon-Tyne Gas Company. It will be seen from the Table that all variations in the quotations show an upward tendency, with the exception of the Sheffield stocks, which have fallen three points on the *ex* div. quotations.

The following quotations were recorded during the week:

On Monday, Brighton and Hove 5 p.ct. 94½, British Gas Light 110, 110½, Commercial 88, Gas Light and Coke 87, 87¼, 87⅜, 87½, 88, 4 p.ct. preference 76, 6 p.ct. Brentford debenture 102⅜, Imperial Continental 141, 141½, Liverpool 7 p.ct. preference 104½, Primitiva 16s. 9d., 17s. 1½d., South Metropolitan 102¼, 103.

On Tuesday, British Gas Light 109⅝, 110⅜, 111, 4 p.ct. debenture 74, European 6⅞, 6¹¹⁄₁₆, 6¹³⁄₁₆, Gas Light and Coke 87½, 87⅞, 88, 3½ p.ct. 59⅜, 60, Portsmouth (4 p.ct. standard) 103½, Primitiva 16s. 9d., 17s., South Metropolitan 102½, South Suburban 5 p.ct. debenture 93½, 94, 95. Supplementary prices, Redhill 80.

On Wednesday, Bournemouth 6 p.ct. preference 11, 11¹⁄₁₆, Brighton and Hove 6 p.ct. 104, 104¼, 5 p.ct. 94¼, 94½, Commercial 87¼, Croydon sliding-scale 97¾, 98, European 6¹³⁄₁₆, Gas Light and Coke 87⅝, 88, 88⅛, 3½ p.ct. 60, 4 p.ct. preference 75¼, 76, 76½, 3 p.ct. debenture 59⅝, 6 p.ct. debenture 103¾, Imperial Continental 142, Portsmouth 4 p.ct. 104½, South Metropolitan 102¼, 103, 6 p.ct. preference 110½, 3 p.ct. debenture 58½. Supplementary prices, Aldershot 7 p.ct. bonds 103, Brighton and Hove 5 p.ct. debenture 93, 4 p.ct. debenture 74, Croydon 4 p.ct. debenture 74½, Redhill 5 p.ct. debenture 94.

On Thursday, British 110½, 7 p.ct. preference 115½, 116½, Commercial 87, Gas Light and Coke 87⅛, 87⅝, 87⅞, 88, 88⅛, 88¼, 3½ p.ct. 60, 6 p.ct. debenture 103¾, Primitiva 16s. 7½d., 16s. 9d., 4 p.ct. debenture (1911) 73, South Metropolitan 102½, 6 p.ct. preference 110, 3 p.ct. debenture 58⅛, South Suburban 104½. Supplementary prices, Croydon 4 p.ct. debenture 74½, Hastings and St. Leonards 3½ p.ct. debenture 61, 61¾, Romford 6 p.ct. preference 90s., Ventnor 16½.

On Friday, Brighton and Hove 6 p.ct. 105, British 110½, 111, 111½, Commercial 3 p.ct. debenture 57½, European 6¹³⁄₁₆, Gas Light and Coke, 87⅝, 87⅞, 88, 88⅛, 4 p.ct. preference 76½, 3 p.ct. debenture 59½, 5 p.ct. debenture 99⅜, Imperial Continental 143, Primitiva 16s. 7½d., 16s. 9d., South Metropolitan 3 p.ct. debenture 58⅛, 58⅝, South Suburban 5 p.ct. 103¾, 104½, 104¾, 5 p.ct. debenture 94⅛, 94⅝. Supplementary prices, Croydon 4 p.ct. debenture 75¼.

While stringent conditions prevailed in Lombard Street earlier in the week, towards the close funds were in ample supply, money being freely offered by all the large lenders. Both new and old loans were obtainable at 3½ p.ct., and finally new money declined to 3 p.ct. The Treasury Bills, as was expected, were allotted at a higher rate than a week ago, averaging £4 7s. 3·71d. p.ct.—an increase of about 5d. p.ct.

Foreign exchanges as a rule showed little variation, but the improvements in Sterling continued. The New York rate closed at 4.86$\frac{13}{32}$, being the highest point reached since July, 1926. French francs were unaltered at 124; but Italian lire recovered $\frac{3}{32}$ to 89$\frac{3}{32}$. Spanish pesetas finished slightly lower at 28.63; and the Dutch rate moved in favour of this country to 12.13$\frac{7}{8}$. Belgas were firm at 34.92.

Silver on Chinese support rose ½d. to 25$\frac{5}{8}$d. per oz.; while Gold remained at 84s. 11½d. per oz.

The Bank Rate is 4½ p.ct., to which it was reduced from 5 p.ct. on April 21. The Banks' deposit rate is 2⅛ p.ct., and the deposit rates of the discount houses are 2¼ p.ct. at call and 2⅜ p.ct. at notice.

Issue.	Share.	When ex-Dividend.	Dividends. Prev. Hf.Yr	Dividends. Last Hf. Yr.	NAME.	Quotations. Sept. 16.	Rise or Fall on Week.	Transactions. Lowest and Highest Prices.
£			%p.a.	% p.a.				
171,978	Stk.	Feb. 10	5	5	Aldershot 5 p.c. max. C.	68—73*	..	..
323,992	,,	,,	4	4	Do. 4 p.c. Pref.	67—70*	..	..
1,651,868	,,	Apl. 7	6½	7	Alliance & Dublin Ord.	84—87	..	..
274,000	,,	July 14	4	4	Do. 4 p.c. Deb.	84—87	..	..
523,654	,,	Aug. 25	—	7	Barnet Ord. 7 p.c.	101—104	..	..
300,000	1	Apl. 28	1/7½	1/7½	Bombay, Ltd.	1$\frac{1}{16}$—1$\frac{3}{16}$	..	..
170,000	10	Aug. 25	8½	8½	Bournemouth 5 p.c.	12½—13½	..	..
500,000	10	,,	7	7	Do. B 7 p.c.	12—12½	..	..
275,000	10	,,	6	6	Do. Pref. 6 p.c.	10⅜—11⅛	..	11—11$\frac{1}{16}$
50,000	Stk.	June 29	3	3	Do. 3 p.c. Deb.	55—58	+1	..
163,085	,,	,,	4	4	Do. 4 p.c. Deb.	74—77	..	..
357,900	,,	Aug. 25	—	7½	Brighton & Hove 6 p.c. Con.	102—105	..	104—105
341,800	,,	,,	—	6/8/6?	Do. 5 p.c. Con.	92—95	..	94½—94½
1,327,500	,,	July 28	5	5	Bristol 5 p.c. max.	84—85a	..	..
535,000	,,	Mar. 24	8	7	British Ord.	109—112	+1	109⅝—111½
100,000	,,	June 29	7	7	Do. 7 p.c. Pref.	112—117	..	115½—116½
150,000	,,	,,	4	4	Do. 4 p.c. Red. Deb.	73—78	..	74
200,000	,,	,,	—	88/2	Do. 5 p.c. Red. Deb.	94—96	..	..
160,000	10	May 26	6	8	Cape Town, Ltd.	7⅝—8½	..	..
100,000	10	Apl. 28	4½	4½	Do. 4½ p.c. Pref.	6—7	..	..
150,000	Stk.	June 29	4½	4½	Do. 4½ p.c. Deb.	70—75	..	..
626,850	,,	July 28	6	6	Cardiff Con. Ord.	100—103	+3	..
227,840	,,	June 29	7½	7½	Do. 7½ p.c. Red. Deb.	99—102	..	..
187,150	,,	Aug. 11	6½	5	Chester 5 p.c. Ord.	87—92b	..	..
79,165	1	Apl. 28	12/-	12/-	Colombo Ltd. Ord.	29/—31/-	..	..
34,495	1	,,	1/6½	1/6½	Do. 7 p.c. Pref.	20/—22/-	..	..
831,490	1	Apl. 7	1/9½	1/9½	Colonial Gas Assn. Ld. Ord.	25/—27/-	..	..
178,900	1	,,	1/7½	1/7½	Do. 8 p.c. Pref.	20/—22/-	..	..
2,073,280	Stk.	July 14	—	5	Commercial Ord.	86½—88½	..	87½—88
476,000	,,	June 16	3	3	Do 3 p.c. Deb.	56—59	..	57½
369,800	,,	Sept. 30	12	11	Continental Union, Ltd.	31—36	..	..
200,000	,,	Mar. 10	7	7	Do. 7 p.c. Pref.	24—26	..	..
727,850	,,	Aug. 11	8½	8½	Croydon sliding scale	95—99	..	97⅞—98
408,100	,,	,,	5	5	Do. max. div.	77—80	..	..
424,270	,,	Aug. 25	9	6	Derby Con.	103—105e	..	..
58,000	,,	June 29	4	4	Do. Deb.	73—75e	..	..
300,000	,,	Aug. 25	5	5	East Hull Ord. 5 p.c.	78—81	..	..
50,000	,,	June 16	5	5	Eastbourne 5 p.c. Deb.	90—95	..	..
1,009,180	10	Mar. 24	13	13	European, Ltd.	6½ 7	..	6½—6$\frac{15}{16}$
13,747,480	Stk.	July 28	5	5	Gas Light & Coke 4 p.c. Ord.	87—89	+1	87—88½
1,600,000	,,	,,	3½	3½	Do. 3½ p.c. max.	59—61	..	59⅜—60
4,127,050	,,	,,	4	4	Do. 4 p.c. Con. Pref.	74½—76½	..	76½—76½
6,000,000	,,	June 16	3	3	Do. 3 p.c. Con. Deb.	58—60	..	59⅛—59⅝
181,818	,,	,,	6	6	Do. 6 p.c. Br'tf'd Rd. Db.	101—104	+1	102½—103½
1,643,770	,,	,,	5	5	Do. 5 p.c. Red. Deb.	98—100	..	99½
48,080	,,	—	7½	7½	Do. 7½ p.c. Ilford Deb.	..	..	..
93,800	,,	Aug. 25	6½	6½	Hastings & St L. 5 p.c. Conv	88—91	..	..
288,740	,,	,,	5½	5½	Do. 5½ p.c. Conv.	76—79	..	..
70,000	10	Apl. 28	†10	†10	Hongkong & China, Ltd.	12—13	..	..
178,800	Stk.	Aug. 25	5	5	Hornsey Con. 5½ p.c.	65—68	..	..
1,978,000	,,	May 12	10	10	Imperial Continental Cap.	140—142	+1	141—143
268,180	,,	Aug. 11	3½	3½	Do. 3½ p.c. Red. Deb.	68—70	..	..
336,342	,,	Aug. 11	6½	7	Lea Bridge 5 p.c. Ord.	94—97	..	..
2,145,907	,,	Aug. 11	5½	5½	Liverpool 5 p.c. Ord.	84—85	..	..
600,000	,,	Sept. 30	7	7	Do. 7 p.c. Red. Pref.	103—105b	..	104½
145,788	,,	Aug. 25	8	9	Maidstone 5 p.c. Cap.	107—112	..	..
88,480	,,	June 16	3	3	Do. 3 p.c. Deb.	52—55	+1	..
78,800	5	June 16	†7	†8	Malta & Mediterranean	5—5½	..	..
541,980	Stk.	May 26	†5	†7	Montevideo, Ltd.	90—92	..	..
2,981,818	,,	July 28	5	5	Newcastle & Gateshead Con.	74½—75½d	+½	..
380,929	,,	,,	4	4	Do. 4 p.c. Pref.	69½—70½d	+½	..
691,705	,,	June 29	8½	8½	Do. 8½ p.c. Deb.	66½—67½d	..	..
131,785	,,	Aug. 25	—	6/18/0	North Middlesex 6 p.c. Con.	90—93	..	..
800,000	,,	Apl. 28	9	7	Oriental, Ltd.	100—102	..	..
186,120	,,	June 29	7½	7½	Plym'th & Ston'house 5 p.c.	102—107	..	..
414,400	,,	Aug. 25	7½	7½	Portsm'th Con. Stk. 4 p.c. Std.	102—105	..	103½—104½
236,782	,,	,,	5	5	Do. 5 p.c. max.	76—79	..	..
2,399,909	1	—	—	—	Primitiva Ord.	16/6—17/6	..	16/7½—17/1½
292,200	100	June 1	4	4	Do. 4 p.c. Red. Deb.	84—86	..	..
600,000	Stk.	July 28	4	4	Do. 4 p.c. Red. Deb. 1911	72—74	+1	73
434,968	,,	June 29	—	4	Do. 4 p.c. Cons. Deb.	72—74	+1	..
180,000	10	Mar. 24	6	6	San Paulo 6 p.c. Pref.	7½—7⅝	..	..
135,000	50	June 29	5	5	Do. 5 p.c. Red. Deb.	46—49	..	..
270,000	Stk.	Mar. 24	5⅝	5⅝	Sheffield A	99½—100⅞e*	−3	..
419,968	,,	,,	5⅝	5⅝	Do. B	99½—100⅞e*	−3	..
1,047,000	,,	,,	5⅝	6⅛	Do. C	99½—100⅞e*	−3	..
50,000	10	May 26	4	6	South African	4—6	..	..
6,809,895	Stk.	Aug. 11	7	5	South Met. Ord.	101½—103½	..	102½—103
500,000	,,	—	—	—	Do. 6 p.c. Irred. Pf.	109—112	..	110—110½
1,895,445	,,	July 14	3	3	Do. 3 p.c. Deb.	57—60	..	58½—58⅝
734,000	,,	Mar. 10	6½	6½	Do. 6½ p.c. Red. Db.	100—102*	..	..
91,800	,,	Aug. 11	8½	8½	South Shields Con.	101—108d	..	..
1,349,796	,,	July 28	6½	6½	South Suburban Ord. 5 p.c.	102—105	..	103½—104½
868,827	,,	June 16	5	5	Do. 5 p.c. Deb.	93—96	+1	93½—95
647,740	,,	Mar. 24	5	5	South'mpton Ord. 5 p.c. max	73—76*	..	..
121,275	,,	June 29	4	4	Do. 4 p.c. Deb.	71—74	..	..
380,000	,,	Aug. 25	7	7	Swansea 7 p.c. Red. Pref.	100—102	..	..
200,000	,,	June 16	6½	6½	Do. 6½ p.c. Red. Deb.	100—102	..	..
150,000	,,	July 28	7½	7½	Tottenham District A 5 p.c.	105—108	..	..
662,275	,,	,,	6½	6½	Do. B 5½ p.c.	89—92	..	..
180,000	,,	,,	5½	5½	Do. 5½ p.c. Pref.	95—98	..	..
181,365	,,	June 16	4	4	Do. 4 p.c. Deb.	72—75	+2	..
258,251	,,	Mar. 10	5	5	Tynemouth Con. and New Uxbridge, Maidenhead, &	83—86d	+10½	..
289,094	,,	Aug. 25	6½	6½	Wycombe 5 p.c.	85—90	..	..
88,380	,,	,,	5	5	Do. 5 p.c. pref.	88—88	..	..
					Wandsworth, Wimbledon, and Epsom—			
80,000	,,	July 14	8½	8½	Wandsworth A 5 p.c.	117—122	..	..
255,882	,,	,,	7	7	Do. B 3½ p.c.	100—105	..	..
482,535	,,	,,	5/19/0	5/19/0	Do. C and New	88—93	..	..
882,000	,,	,,	6⅝	6⅝	Do. Wimbledon 5 p.c.	98—103	..	..
98,000	,,	,,	7⅛	7⅛	Do. Epsom 5 p.c.	100—105	..	..
200,000	,,	,,	5	5	Do. 5 p.c. Pref.	88—88	..	..
88,416	,,	June 29	3	3	Do. 3 p.c. Deb.	55—56	+1	..
284,743	,,	,,	4	4	Do. 4 p.c. Deb.	73—76	..	..

Quotations at:—a.—Bristol. b.—Liverpool. c.—Nottingham. d.—Newcastle e.—Sheffield. * Ex. div. † Paid free of income-tax. ‡ For year.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Sept.* 19.

Pitch is somewhat quiet, but the price is steady at 92s. 6d. to 95s. per ton.

Creosote is in considerable demand, and is firm at 8¾d. net per gallon.

Tar spirits are unchanged; pure benzole being 1s. 5d. to 1s. 6d. per gallon, pure toluole 2s. per gallon, 95/160 solvent naphtha 1s. 2d. to 1s. 3d. per gallon, and pyridine 6s. to 6s. 6d. per gallon.

Tar Products in the Provinces.

Sept. 19.

There is very little alteration in markets for tar products.

Pitch is rather easier, although makers are maintaining their prices and there is very little offering.

Creosote remains very firm indeed, with a strong demand both for home consumption and export.

Tar acids keep firm, with a very good demand for the end of the year and still a fair amount of inquiry for next year.

Crude carbolic remains active for both prompt and forward delivery.

The average prices of gas-works products during the week were: Gas-works tar, 64s. 3d. to 69s. 3d. Pitch—East Coast, 87s. 6d. to 90s. f.o.b. West Coast—Manchester, 82s. 6d. to 85s.; Liverpool, 85s. to 87s. 6d.; Clyde, 86s. to 89s. Benzole, 90 p.ct., North, 1s. 2d. to 1s. 3d.; crude, 65 p.ct. at 120° C., 10¼d. to 10½d., naked at makers' works; 50/90 p.ct., naked, North, 1s. 3d. to 1s. 4d. Toluole, naked, North, 1s. 4d. to 1s. 5d. nominal. Coal-tar crude naphtha, in bulk, North, 7¼d. to 8d. Solvent naphtha, naked, North, 8¼d. to 9¼d. Heavy naphtha, North, 10d. to 1s. Creosote, in bulk, North, liquid, 7¼d. to 7⅝d.; salty, 7⅜d. to 7½d.; Scotland, 7¼d. to 7⅝d. Heavy oils, in bulk, North, 8¾d. to 9d. Carbolic acid, 60 p.ct., 2s. 6d. to 2s. 7d. prompt. Naphthalene, £11 to £14; salts, £5 to £5 10s., bags included. Anthracene, "A" quality, 2½d. per minimum 40 p.ct., purely nominal; "B" quality, unsaleable.

Coatbridge Gas Company.

At the annual meeting of the Company, the Chairman (Mr. A. S. Legat) moved the adoption of the report, which recommended the payment of dividends at the rate of £7 15s. p.ct. per annum on the original stock and £5 8s. 6d. p.ct. on the four issues of £10 shares (actual), all less income-tax. He thought the report was very satisfactory, considering the coal stoppage. They had had to pay for fuel as much as 70s. per ton; the result being that their fuel bill, as compared with the previous year, was £12,000 more for 700 tons less. On the income side, sales of gas had realized £4480 more than in the previous year for almost the same quantity of gas—due to the increased price which they had to charge during the last nine months of the year. The sum realized for residuals was £7050 more than in the previous year; and this, along with the extra amount received for gas, was within £500 of balancing the increased cost of coal. Regarding the current year, they had contracted for their coal at what they considered reasonable rates; and this had enabled them to reduce the price of gas as from July 1 last to that obtaining prior to the coal stoppage. During the last two winters the demand for gas at times almost reached the producing capacity. They had, therefore, this year been erecting additional carbonizing plant, which would be ready to put in operation before the coming winter, and would place the Company in a comfortable position as to output for a number of years to come. The net result of the year's working was that they carried forward a balance available for dividends of £3163, or £506 more than was brought-in.

Cheaper Gas at Wigan.—The price of gas at Wigan has been reduced by 4d. per 1000 c.ft.

Cheaper Gas at Welshpool.—At the annual meeting of the Welshpool Lighting and Power Company, it was decided to reduce the price of gas to 5s. 5d. per 1000 c.ft. It was also decided to pay a dividend of 6 p.ct.

New Sports Ground of the Birmingham Gas Department.—The Lord Mayor of Birmingham formally opened, on Saturday last, the new sports ground of the Birmingham Gas Department, at Erdington. It is 25 acres in extent, and admirably appointed. A report of the proceedings will appear next week.

South Australian Gas Company.—The Directors of the Company, which supplies Adelaide, report for the year ended June 30 a profit (before providing for the special purposes fund) of £112,439. A dividend of 8 p.ct. per annum absorbs £80,373; and the balance of £32,066 has been transferred to the special purposes fund.

Deal and Walmer Gas Company.—In their report for the year ended June 30, the Directors state that the gas sold shows an increase of about 1 p.ct. over the previous year, and would have been greater but for the restrictions imposed owing to the coal strike. Under the advice of their Consulting Engineers (Messrs. Anderson Bros., of Westminster) and Manager (Mr. J. F. Tyndall), and after visiting gas-works where vertical retorts are in operation, they recently decided to instal these retorts, which are now on the eve of being brought into use. A dividend of 7½ p.ct. per annum is recommended for the last half-year, the same as the interim dividend paid in March last. Immediately after the conclusion of the ordinary business of the meeting, which will be held on Sept. 28, an extraordinary meeting will be held, to consider a resolution for increasing the capital of the Company, for the purposes of defraying the cost of the vertical retort system and other expenditure necessitated by the increase of business.

Perfecta Meters is the title of a Company registered, with a capital of £15,000, to carry on business as manufacturers of gas meters.

Price Reduction at Dungannon.—The Dungannon (Co. Tyrone) Gas Company have reduced the price of gas from 7s. 11d. to 7s. 6d. per 1000 c.ft.

Gas Cheaper at Congleton.—The Congleton Gas Committee have decided to reduce the price of gas by 6d. per 1000 c.ft. from the end of the September quarter.

Reduction in Price at Liverpool.—The Directors of the Liverpool Gas Company have decided to reduce the price of gas to all consumers through ordinary meters to 8d. per therm, as from the September quarter meter readings.

Reduction in Price at Newtown.—The Newtown Urban District Council have decided to reduce the price of gas as follows: To 1s. per therm for power consumers, 1s. 3d. per therm for ordinary consumers, and 1s. 6d. per therm for slot-meter consumers.

Further Reduction in Price at Redhill.—The Directors of the Redhill Gas Company announce that a further reduction in the price of gas, amounting to one-fifth of a penny per therm, will come into force after the reading of the ordinary meters for the Michaelmas quarter. The charge will then be lower than that ruling before the general strike.

Walking Record at 52.—Mr. A. E. Wooller, aged 52, an employee of the Brighton and Hove General Gas Company, set up a new walking record for the London-Brighton Road during the week-end by walking from Brighton to London and back in 25 hours 45 minutes. The journey, with London as the starting-point, has been accomplished more quickly, but the time is good for a man of 52.

Australian Gas Light Company.—The net profits for the year ended June 30, including the balance brought forward, amounted to £319,026. The Directors recommend the payment of a dividend for the half-year to June 30 at the same rate as that paid for the previous half-year—viz., 4 p.ct. on the "A" and "B" shares—and the carrying forward of £36,270. The capital of the Company was further increased during the year by the creation of 40,000 new "A" shares.

Marlborough Gas and Coke Company, Ltd.—In the half-yearly report of the Directors of this Company, it is stated that the sales of gas and residual products show a considerable increase over the corresponding period of last year. After writing off £400 for depreciation, transferring £206 to reserve fund, and making provision for all other charges, the profits amount to £1519; and the Directors recommended the payment of a dividend of 7 p.ct. per annum, and the transference of £75 to reserve.

Mainlaying at Stockton.—The Stockton-on-Tees Gas Committee are carrying out improvements to the service to the southern and western districts of the town, in which no main extensions have taken place for about forty years. A 24-in. main is being laid through the most populous part of the town, from the gas-works to Yarm Road, to supplement or replace old mains of 9 in. or 10 in. diameter, which are no longer adequate in view of the recent increased consumption. In the year ended March 31, the consumption in the Stockton area was 624 million c.ft., compared with 421 million c.ft. in the year ended March 31, 1923.

Co-Partnership Introduced at Woking.—A further decrease of ¼d. per therm, or 2½d. per 1000 c.ft., in the price of gas was announced at the half-yearly meeting of the Woking District Gas Company, which was presided over by Mr. Lawrie Trewby, the Chairman. The quantity of gas sold during the half-year to June 30 showed an increase of 13·96 p.ct.; and it was recommended that out of a disposable balance of £7162, dividends for the half-year should be declared at the following rates per annum, leaving £475 to be carried forward to the next account: On the "O" ordinary stock, 7 p.ct.; on the "B" ordinary stock, 7 p.ct.; on the "C" preference stock, 5 p.ct.; and on the 8 p.ct. redeemable preference stock, 8 p.ct. The Chairman introduced a proposal to adopt a scheme of co-partnership for the Company's employees, and outlined the rules. The resolution received unanimous support.

Alliance and Dublin Consumers' Gas Company.—The Directors of the Alliance and Dublin Consumers' Gas Company have issued their report for the half-year ended June 30 last. The accounts show a profit on the revenue account of £82,996: and, after providing for interest on debenture stock and interest on temporary loans, there remains the sum of £74,110, to which must be added £3389, being the balance brought from last account, and a credit from income-tax amounting to £2884, making a total of £80,384. The Directors recommend the declaration of a dividend on the consolidated ordinary stock of the Company at the rate of 7 p.ct. per annum (this being the maximum statutory dividend permissible under the sliding-scale provisions), less income-tax, which will absorb £54,315. A balance of £26,069 will remain to be carried to the next account. The sales of gas again show an increase of nearly 20 p.ct. on the corresponding period, and the Directors hope to announce in the near future a further reduction in the price of gas.

The Madeley (Salop) Urban District Council have accepted the tender of the Ironbridge Gas Company to light the lamps in their area.

Application has been made by the Thornton-le-Fylde Urban District Council to the Ministry of Health for sanction to borrow £992 for additions to the gas-works.

Recently there has been a great increase in the use of gas for heating purposes at Stockton-on-Tees; and nearly 1500 cookers alone were issued last year. In order to develop further this part of the business, the Gas Department are to erect a temporary showroom at the works.

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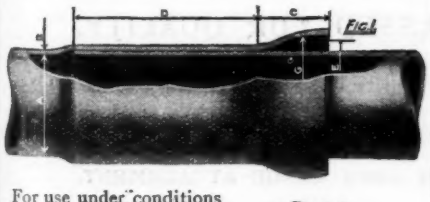
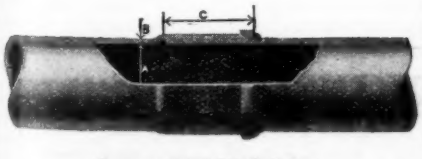


For use under conditions where the ground is liable to movement.



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Bromford resources in manipulation enable us to produce all types of coils in extra-long one piece continuous lengths.

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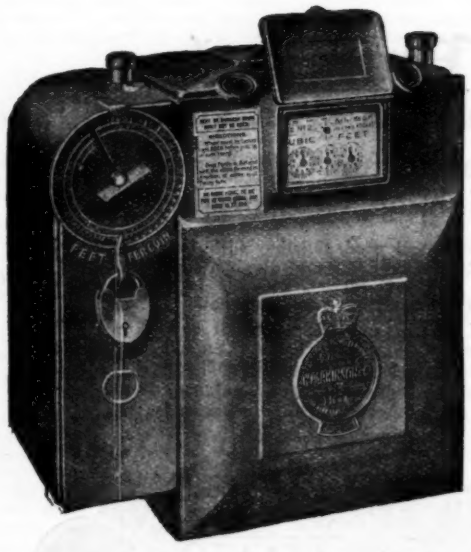

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